UNIVERSITY
of
GLASGOW

Essays in Corporate Investment and Finance in China

by

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Submitted in fulfilment of the requirements for
the Degree of Doctor of Philosophy

Adam Smith Business School

College of Social Sciences

University of Glasgow

July 2018

Abstract

This thesis extends the literature by adding new empirical evidence associated with firm's decisions in fixed investment and capital structure, under the assumption of capital market imperfection. In Chapter 2, we combine a panel of over 95,000 Chinese manufacturing firms of different ownership types over the period 2000-2007 with the Marketization Index for China's provinces during the same period and investigate whether or not, and how, the cross-regional differences in institutions and financial development can affect the firm level financing constraints. Our main results indicate that institutional and financial development in China can reduce financing constraints significantly for the investments of private firms and partly for foreign firms, while increasing the financing constraints for the investments of state and collective firms. Different from previous studies at aggregate level, we identify a positive relation between finance and growth in the Chinese economy from a micro-perspective. In Chapter 3, we estimate the respective effect of state ownership and share concentration on firms' leverage adjustment speed towards optimal level by using the Chinese listed firms dataset (1998-2010). We find that the firms with state ownership present lower leverage adjustment speed towards optimal leverage ratio than their privately owned counterparts. A positive relation from share concentration to leverage adjustment speed is also detected. These results suggest that ownership structure can significantly determine a firm's costs of adjustment as well as incentives to adjust. Our works offer a new channel for people to understand the heterogeneous leverage adjustment behaviours among firms. In Chapter 4, using the Chinese listed firms dataset (1998-2016), we test the casual relation from short debt maturity to firms' fixed capital expenditure. After controlling the level of leverage, we obtain a significant negative coefficient on short debt maturity in the investment regression model, especially for the sample of firms with worse financial condition. This indicates that rollover risk plays an important role in determining firms' investment decisions and it is more likely to be triggered at bad time. Overall, our research suggest several policy implications. First, deeper economic decentralization and further financial liberalization are important for reducing the resource misallocation between state and non-state sectors in the Chinese economy. Second, more applicable provisions for minority investor protection are required to be formulated, which are expected to provide more options for ownership reform in publicly listed SOEs. Lastly, alternatives for long-term debt financing, other than bank loans, can be developed, thereby reducing the systematic rollover risk in the economy.

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Acknowledgements

First of all, I would like to express my deepest gratitude to my supervisors Dr Sai Ding and Dr Minjoo Kim. They taught me how to do research in financial economics. Their encouragement, patience and support contributed greatly to my thesis.

I am grateful to Professor Guy Liu and Dr Vasilios Sogiakas for their helpful comments and suggestions.

I am also grateful to the Adam Smith Business School at the University of Glasgow for financing my training and organising various activities. I especially thank my colleagues and friends, Dr Ding Liu, Hao Peng, Hualin Li, Jinpeng Liu, Jiren Wei, Jiangteng Zhou, Pengcheng Song, Xinxin Ma, Yihan Zou, Yuexiang Wu, Zerun Liu and Zhekai Zhang for their friendship.

Whatever I achieve today, I owe to my parents. I am very grateful for their unconditional love and support.

Dedication

This dissertation is dedicated to my parents

Declaration

I declare that, except where explicit reference is made to the contribution of others, that this dissertation is the result of my own work and has not been submitted for any other degree at the University of Glasgow or any other institution.

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Chapter 1

Introduction

1.1 Motivations

Frictions in the capital market connect a firm's real decisions with its financing activities. For example, either agency conflict or asymmetric information can substantially increase the costs of external finance and dampen managers' incentives to capture growth opportunities when firms' internal funds are limited. This general definition of financing constraint sets up a channel for information and agency problems to determine firm-level real economic outcomes. Using Chinese firm-level datasets, in this thesis, we aim to extend the literature by adding new empirical evidence associated with firm's decisions in fixed investment and capital structure given imperfections in the capital market.

There are several reasons for us to choose China as a laboratory for studying firm's behaviours. First, China has an immature capital market full of frictions. In detail, lending activities in the financial system are controlled by the banking sector which is dominated by four state-owned banks (Ayyagari et al., 2010). Other official financing channels, such as equity and public bond, are not comparable to the banking sector either in size or importance and have very high entry requirements (Allen et al., 2008). Furthermore, there is a well-known 'political pecking order' of domestic firms in the economy (Huang, 2003). Government policies provide large preferential treatment to the firms controlled by central or local authorities while strongly discriminating against domestic privately owned firms. Even worse, China's law and institutions, including investor protection systems, corporate governance, accounting standards and quality of government, are significantly less developed than many other emerging economies (Allen et al., 2005). Given a bank loan dependent credit-supply system plus deep government intervention but poor legal protection, the private and non-state sectors are believed to face a high degree of external financing constraint in the domestic capital market. If detecting the working mechanism of frictions such as financing constraint is essential for understanding the incentives behind a firm's real economic decisions, then Chinese firms' datasets provide an excellent opportunity for us to do so.

Over the past two to three decades, China has been improving very quickly in many aspects and no other country's economy can match Chinese potential. For instance, although the stock market was initially established for financing very largest state owned firms and remained thin at first, it has presented a sort of explosive development after the non-tradeable share reform starting in 2005. At the end of 2015, the A-share market had a

combined value of 8.53 trillion US dollars, of which tradable shares accounted for more than 60% of China's GDP that year.[1] Comparing across countries, probably only the New York Exchange would be larger. In terms of the banking sector, improvements can also be observed. The level of non-performing loans over GDP has been steadily decreasing after reaching its peak during 2000-2001 (Allen et al., 2008). In 2012, around 52% bank loans had flowed to the private sector (Lardy, 2014). Although it is not clear whether or not these loans can largely satisfy the requirement from private enterprises, we should at least be able to conclude that domestic banks indeed support the rise of private business in China. More essentially, the Chinese government continuously takes steps to improve laws and enforcement. For example, China's Code of Corporate Governance was released in 2002 and its implementation resulted in disclosure of information about large shareholders in listed firms.[2] After almost 10 years discussion and verification, the property law in China was finally implemented on 1st October 2007. Besides, after entering WTO, the reform of state owned firms has gradually shifted from direct privatization to corporatization. Further separation between ownership and management is expected to make the remaining large state owned firms behave more competitively[3] (Geng et al., 2009). Overall, China is moving away from a planned economy to a market-oriented one. A better understanding of the impact from these institutional and financial changes on firms' decisions may help us to explain why China is growing so quickly.

Lastly, as the largest transition economy in the world, China has a business environment which is very different from that of many developed countries. The observed firm-level decisions should reflect such differences. However, the main stream theories in modern corporate finance literature are developed to fit the data of western firms, particularly the firms in the United States. Although it may sometimes be appropriate to view Chinese empirical findings from a Western perspective, at other times it may not be. Economic reform should be a long-term project. Positive changes happened, but time is still required. Instead of emphasizing how big the gap between the situation in China and the ideal case suggested by western theories could be, it is more meaningful for us to take advantage of such differences and to rationalize the seemingly 'unreasonable' behaviours of Chinese firms. From the standpoint of firms' decision makers, our work may provide several useful suggestions for them to optimize their choices given some existing common frictions in

[1] KPMG report (2016): https://assets.kpmg.com/content/dam/kpmg/pdf/2016/03/china-outlook-2016.pdf
[2] Several managers and stakeholders were even arrested at end of 2004 due to illegal behaviours in the stock markets (Jiang et al., 2010).
[3] The slogan was 'grasping the large and letting go the small'.

China's capital market. Referring to public policy, the results may demonstrate general directions for governments and authorities to ameliorate their strategies drawn for promoting economic prosperity.

1.2 China Background

1.2.1 State owned firms reform

The reform of state-owned enterprises (SOEs), began almost four decades ago at the beginning of economic recovery after The Culture Revolution (1966 – 1977), is nowadays one of the most important remaining issues in China's transition to a market economy. Given a centralized economy, SOEs functioned as passive agents of the state economic bureaucracy and their workers lacked motivation. The information can be seriously distorted from production floor to management team and to state agencies. Therefore, in 1979, the Chinese government started to grant more autonomy provisions to (selected) enterprises. Firms were allowed to retain a portion of their profits rather than handing them over in their entirety to the Ministry of Finance. Meanwhile, a dual-track pricing system replaced a unitary system of state fixed prices. The new incentive mechanisms were proved to be effective at improving productivity and investment of SOEs in 1980s (Groves et al., 1994; Groves et al., 1995; Li, 1997). It seems that efficiency can be acquired even without real privatization of SOEs (Lau et al., 2000). Nevertheless, the autonomy system quickly resulted in serious 'insider control' issue that enterprise managers often colluded with workers and used their control over assets of SOEs to benefit themselves at the expense of the state (Qian, 1996). The soft budget constraints which were backed by the lending from state owned banks further deteriorated the situation. The magnitude of financial losses of SOEs soared, reaching a peak of 3% GDP in 1990. The debt to equity ratio of SOEs was over 300% in 1994 and 85% of debt was bank loans (Lardy, 1998). Annual profits of SOEs can only cover half of the interest payments.

A major turning point emerged in the 3rd Plenum of the 14th Party Congress in Nov. 1993 (Qian and Wu, 2003). The plan of privatization was firstly proposed. Latter in the fall of 1995, the Central Committee endorsed the idea of 'grasping the large and releasing the small' (Garnaut et al., 2005). The status of large SOEs were further strengthened while the lose making small and medium SOEs were allowed to be sold to private investors or

simply went bankruptcy. The number of industrial SOEs fell from 127600 in 1996 to 61300 in 1999 (NBSC[4], 2000). The remaining SOEs were either traditional ones or transferred limited liability firms and shareholding limited companies in which the state is the majority or dominant shareholder. The profitable operations of those very largest SOEs were carved out and (partially) privatized through initial public offering in Shanghai and Shenzhen stock markets. On the aggregate level, the reform over this period was likely to be successful. The proportion of SOEs with negative profits declined from around 40% in 1996 to 25% in 2007. The corresponding losses of these SOEs to GDP were reduced from 2.9% in 1990 to 0.3% in 2007. The average return on assets quintupled to about 5% in 2007 than in 1996 (Lardy, 2014). Nevertheless, the micro-level evidences provide somewhat mixed implications. The reformed/privatized POEs presented significant improvement in (labour) productivity, output, real sales and leverage controlling but relatively weak or even further reduction in financial performance, e.g. profitability (Zhang et al., 2002; Sun and Tong, 2003; Wei et al., 2003; Wang, 2005; Chen et al., 2006; Zhang et al., 2012). Such divergence between real and financial performances may indicate the non-profit maximizing strategy of SOEs during the reform. If a firm's output bias is sufficiently strong, an increase in productivity can lead to even lower profit and hence lower efficiency (Bai et al., 1997). Besides, the incomplete partial privatization resulted in strong agency conflicts, i.e. the separation between ownership and control. SOEs were easily immersed in a vicious cycle of policy burdens, subsidies, agency problems, and political interventions.

New directions of SOEs reform are presented in several recent notable studies. Liu et al. (2015) look at the implications of both full and partial privatizations of SOEs. They argue that different ownership structures have different advantages. For instance, privately-controlled scenario performs better in terms of profitability while partially privatized firms are more effective in improving labor productivity. Meanwhile, private 'insider-controlled' firms are more willing to take investment intensive strategy for the future. Therefore, given a gradually improving corporate governance mechanism in China, it is possible for the policy makers to achieve different objectives by drawing the advantages of different ownership structures in the process of ongoing economic transition. More rigorously, Hsieh and Song (2015) find that the fast growth of SOEs' total factor productivity can be attributed to the dramatic improvement of their labor productivity. However, SOEs' capital productivity remained significantly lower than that of POEs. The intrinsic reason should be

[4] National Bureau of Statistics of China

that many capital intensive industrial SOEs were established in China's history when the capital was actually very scarce (Lin et al., 1998). Such model helped the forming of the initial industrial sectors but it also created a sort of twisted capital pricing system which was inherited by the economy over many subsequent years. This emphasizes the importance of developing a capital market which can more effectively balance the requirements of state and non-state sectors.

1.2.2 Raise of private sector

Chinese private businesses arose and survived in the seam created by the SOEs reform at the end of 1980s and quickly became prosperous over the last two decades. The implementation of 'contracting to households' in rural areas over 1979 - 1984 greatly improved the agriculture productivity and released a huge amount of labour force available for development of urban private sectors (Sachs and Woo, 1997). According to the official data published by NBSC (2016), the number of registered POEs increased from 443000 in 1996[5], only around 25% of total registered firms, to 8656494 in 2015, around 68.7% of total registered firms. In industrial sectors, the number of registered POEs increased from 14600 in 1999 to 216506 in 2015 and the share of industrial output rose from 4.4% to 34.8% over the same period. Furthermore, at the end of 2015, 61.2% and 46.3% of the domestic retail and catering[6] firms were registered under the private category and respectively generated more than 30% and 34.1% of total major operating income in the industry. The situation is even more astonishing in terms of employment. For instance, Lardy (2014) argue that since 1978, almost all of the growth of urban employment in China is due to the expansion of private businesses and the increase in private urban employment, almost entirely the result of the formation of new POEs, accounts for 95% of the growth of the urban labor force. The NBSC (2016) shows that there were only 0.15 million employees in urban POEs and individual businesses at the end of 1978 but the number quickly reached 20.4 million in 1995 and further soared into 189.8 million in 2015, i.e. almost 79% of total urban employment. Nevertheless, the official database has obvious weaknesses that only the 'above scale' 'registered' firms are considered[7], which can significantly understate the actual contribution of private sectors. For example, the 2004 national economic census revealed that there were 947000 registered private industrial firms, including the below

[5] The National Bureau of Statistics of China (NBSC) record available online started at 1996.
[6] The catering category includes catering, accommodation and tourism.
[7] Before 2011, the NBS used the cut-off point 5 million RMB annual sales revenue. After 2011, the threshold was raised to 20 million RMB.

scale ones, whose output occupied 22.4% of total registered industrial firms in 2004 (only 16.5% from NBS data). Furthermore, Dougherty et al. (2007) show that privately registered and privately controlled (but registered as non-POEs) domestic industrial firms together accounted for 33.1% of value added in industry even at year 2003. Therefore, the economic importance of private businesses over the past few decades is expected to be larger than what has been presented in NBSC (2016) once we consider those below scale POEs and those POEs that registered under other non-private categories.

1.2.3 Regulations and Legal Evolution

The natural question is: why does private sector grow so fast? The common answer can be the greater efficiency of private firms. However, people may prefer to further ask: how did private sector grow so fast given such strong constraints, especially between mid-1980s and early 2000s? The answer is probably beyond all expectations: the evolution of state policy toward the private sector explains almost every major shift. Although such institutional evolution may be described as the (passive) decisions made by authorities who are simply motivated by the requirements of SOEs reform, it is undeniable that these government policies have substantially promoted the growth of private business in China.

The policy environment for private businesses in the early years was basically hostile, but this changed (very) gradually. The National People's Congress in March 1978 adopted a constitutional amendment allowing "individual laborers" to operate "within the limits permitted by law" (Tsai, 2007). The state Council followed up in 1981 with detailed regulations governing individual businesses in urban areas. The society however still showed an inhospitable attitude to private firms[8]. The government did not promulgate the Provisional Regulations on Private Enterprises until 1988. Therefore, to overcome the pervasive market failures and the volatile business environment, many private entrepreneurs chose to seek a crucial helping hand from local government by registering their firms under the collective category (Liu and Sun, 2006). Nevertheless, the ambiguous property rights arrangements between local governments and entrepreneurs resulted in large agency costs that the government owner in the worst case can regard the firm as a 'cash cow' and can transfer its cash assets for public uses, especially when the firm grows

[8] Entrepreneurs were described as exploiters of the working class at that time.

large or obtains public offering[9]. In 1994, the provisions for Limited liability companies and shareholding limited companies were available along with the adoption of the Company Law in China. This indicates that the size of private business will be no longer limited. Although the law established high minimum capital requirements from becoming companies[10], the private entrepreneurs were still enormously enthusiastic. For example, the number of collective firms fell from 1.5 million in 1996 to 0.26 million in 2004. Meanwhile, the number of POE soared from 0.44 million to 3.6 million[11]. In March 1999, the Ninth People's Congress approved a constitutional amendment identifying the non-state economy as 'an essential component' of a mixed economy, a clear improvement from its previous designation as 'an important component' of a state-dominated economy (OECD, 2000). In 2001, the party officially clarified that it would no longer discriminate against POE but would embrace them because of their contributions to China's economic development (Nee and Opper, 2012). In 2005, the state council launched the 36 Articles and encouraged POE to enter the industry previously exclusive for SOE[12]. It also encouraged financial institutions to lend to non-state firms. Lastly, the company law was revised in 2006. The minimum capital requirements for establishing companies were substantially reduced[13]. The establishment of single-person limited liability firm can finally be approved by Law.

1.2.4 Soft Budget Constraints and Capital Misallocation

Soft budget constraints represent a major incentive problem. An enterprise is said to have a soft budget constraint when it expects to be bailed out in case of financial trouble (Kornai, 1980; 1986). Under a soft-budget constraint, Kornai observed, eastern European SOEs did not have to worry about survival, and therefore were subject to various moral hazard problems, thus being lax about firm costs, sales, revenues, and ultimately profits. After the tremendous reforms since mid-1990s, most of the corporatized SOEs in China still remain under control of the state, where they have the explicit or implicit government support. More specifically, Lin and Tan (1999), Cull and Xu (20003) and Megginson et al.

[9] For more details about the ambiguous property rights of collective firms, please see Li (1996) and Tian (2000).
[10] To establish a limited liability company, 0.5 million RMB was required. 10 million RMB was required for a shareholding limited company. In 1994, the average worker wage was only 4500 RMB (NBS, 1995).
[11] Sometimes, it referred to as 'Taking off red hat'.
[12] However, the implementation was slow. For example, Airline approval for private business was suspended after 2007 July and only resumed after May 2013. To further overcome regulatory obstacles for POE, the State Council issued follow-on guidelines in May 2010, i.e. the 'New 36 Articles'.
[13] For limited liability company, only 30,000 RMB is required. For shareholding limited liability company, 5 million RMB is required.

(2014) document that Chinese (listed) SOEs have better access to credit in state-owned banks and can expect to receive financial help in times of distress.

Nevertheless, such 'privileges' are often regarded as the root of the low efficiency in Chinese SOEs, especially for their financial performance (Movshuk, 2004). For recent example, Li et al. (2010) use a census dataset containing most of unlisted Chinese manufacturing firms over 2000 – 2005 and find that SOEs are indeed less efficient that POEs and pay less attention to costs, inventories, accounts receivables, investment, employee welfare, financing, and administration. For publicly listed firms over 2003 – 2013, Chang and Jin (2016) show that a firm controlled by government ministries (SOEs) has a ROA 2.08% (0.98%) points, on average, lower than the reference firms controlled mainly by private investors. These suggest that either direct or indirect government ownership has a detrimental impact on firm (financial) performance. Furthermore, Lam et al. (2017) present that between 2011 and 2015, SOEs occupied more than 50% of total bank credit and almost 40% of total assets but generated only around 22% of total industrial output, more than 50% of total corporate losses and merely 7% return on equity. Lardy (2014) shows that the ROA of industrial SOEs has been less than their cost of capital since 2007 and it was around 8% lower than the ROA of industrial POEs in 2012. According to the data from People's Bank of China in 2014, the proportion of bank loans towards private sector was increasing over the past decade but it still only occupied 16.37% of total bank loans even at the end of 2012.

Plausibly, SOEs with low productivity take a larger share of credit while POEs with high productivity usually have limited access to credit resources (Boyreau-Debray and Wei 2005; Song et al., 2011). Therefore, a more worrisome capital misallocation problem attracts researchers' attention in recent years. Brandt et al. (2013) show that over 1985-2007, the resources misallocation in China lowers aggregate non-agricultural TFP by an average of 20%, which was almost exclusively driven by the increasing misallocation of capital between state and non-state sectors within provinces. Song and Wu (2015) further show that the capital misallocation implies aggregate revenue losses of 20% for Chinese firms over 2004 – 2007. Pan et al. (2016) explain the excess liquidity from the angle of credit inefficiency and use China as an example to show that credit misallocation between SOEs and POEs leads to a decline in credit efficiency and hence a higher M2/GDP ratio. The situation is likely to deteriorate after the implementation of the 4 trillion RMB fiscal stimulus plan (2009 – 2010). Huang et al. (2017) detect that between 2006 and 2013, local

public debt crowded out the investment of Chinese POEs by tightening their funding constraints, while leaving SOEs' investment unaffected. Cong et al. (2017) match confidential loan-level data from the 19 largest Chinese banks with firm-level data on manufacturing firms and document that the credit expansion favored SOEs and firms with lower average product of capital, reversing the process of capital reallocation towards POEs before 2008.

1.3 Research Questions

In China, the phenomenal GDP growth rates (9.4% per annum, average value 2000-2016) are closely associated with the high fixed capital accumulation (almost 40% of GDP per annum on average) which is largely undertaken (more than 65% on average in manufacturing for example) by POEs. Nevertheless, it is universally recognized that POEs in China are strongly financially constrained. One possible explanation for this firm-level finance-growth puzzle in past literature is that Chinese POEs have abundant internal funds (Guariglia et al., 2011 and Ding et al., 2013). This argument, on the other side, implies that the private sector in China may not be able to sustain high growth rates once the competitive advantages used to maintain high profits are eroded. Thus, to maintain continuous prosperity, measures must be taken ensuring a more widespread access to external finance for the private sector. The most straightforward way should be improving the financing environment through institutional and financial developments. More interestingly, if the presence of state assets can crowd out private sectors in the local capital markets, then market-oriented reforms in institutions and the financial market are required to alleviate such credit misallocation caused by the political pecking order mechanism. Given the lower degree of external financial constraints, the growth potential of private sectors can be further released. These inferences motivate us to find answers for the following question:

Q1: Can institutions and financial developments in China reduce the credit misallocation in the domestic capital market?

Corporate financing decisions in China can be affected by government intervention. The Chinese government is usually the largest shareholder of SOEs as well as the owner of the

'big four' state owned banks (Li et al., 2009). The explicit or implicit government support plus the relatively preferential treatment in the debt market may easily push the indebtedness of SOEs into the levels far beyond their sustainable boundaries. After almost four decades' reform, it is interesting for us to explore whether SOEs behave similarly to, or still differently from, POEs in response to the deviations from their optimal capital structures. Additionally, weak legal protections of minority investors and poor corporate governance mechanisms result in highly concentrated ownership structure of Chinese firms. Given these conditions, the major agency costs in China's capital market should be generated by the conflicts between corporate insiders, e.g. managers or shareholders, and outsiders, e.g. creditors or investors. The spread of such agency costs may substantially increase the premium required by external creditors, which in turn impedes firms pursuit of their ideal capital structures.

Generally speaking, ownership structure is an important determinant of a firm's capital structure decisions (Pindado and La-Torre, 2011). Due to costs of adjustment, firms cannot always maintain their optimal capital structure policies (Fischer et al., 1989). The special characteristics of ownership structures of Chinese firms are closely associated with the variation of adjustment costs faced by firms. However, the connection between capital structure changes and a firm's ownership structure is relatively less explored in past literature. Therefore, we would like to fill this gap by taking China as an interesting example and to answer the following question:

Q2: How do state ownership and the degree of ownership concentration affect a firm's capital structure decision dynamically?

The Chinese economy has a bank dominated financial system, in which official lending activities are largely controlled by the credit supply from the banking sector. Therefore, the first choice of debt financing for firms is usually bank loan. It is common knowledge that banks prefer to lend short-term debt (Custodio et al., 2013). Also, poor creditor protection, and low legal and institutional efficiency can result in higher costs but fewer choices for long-term financing (Demirguc-Kunt and Maksimovic, 1998). Besides, China's corporate bond market is poorly developed and the major source of long-term debt available for most of non-financial firms is still bank loan. Although banks have an advantage in minimizing costs of financial distress, they face their own intermediation costs that are passed on to the

borrower, so bank long-term debt is nominally more expensive than public long-term bond (Cantillo and Wright, 2000).

Therefore, the relatively immature capital market together with a bank dominated financial system results in the prevalence of heavy reliance on short-term debt financing among Chinese non-financial companies. For instance, Cai et al. (2008) firstly notice the abnormally low ratio of long-term debt to total debt for Chinese (listed) firms, i.e. 0.23 on average, comparing to the firms in developed economies, e.g. 0.72 in US and 0.59 in German. Although short-term debt can provide relatively low interests advantage at current time, over reliance on it can make firms suffer from high rollover risk which will in turn substantially increase costs of future borrowing (Goplalan et al., 2014 and Wang et al., 2016). The following question then arises:

Q3: What is the firm-level economic outcome of such 'extreme' choice of short debt maturity?

1.4 Methods and Major findings

Our results are largely generated by using regression models. Although we do not exclude the possibility that the above three questions can be explored through other (empirical) approaches, given the existing conditions, we believe that we have chosen the optimal ones. In this section, for each research question, we will firstly introduce the basic empirical methods and then summarize the major findings.

In Chapter 2, we explore Q1 by using the large Chinese unlisted firms' dataset (2000 - 2007).[14] First, we use the investment cash flow sensitivity to infer the degree of financing constraints faced by firms. Fazzari et al. (1988) argue that the investment of more financially constrained firms should be more sensitive to the variation of internal funds, i.e. cash flow. Due to credit misallocation, for example, we see that the coefficient on cash flow variable in the investment regression is larger for POEs than for SOEs. This indicates that POEs are more financially constrained than SOEs. After that, we create an interaction term between the measurement to province-level institutions and financial development

[14] The details of dataset used in this thesis will be introduced in each chapter.

and cash flow variable. If institutions and financial development can lower firm-level financing constraints, then the coefficient for the interaction term should be negative and statistically significant.

The basic results indicate that institutions and financial development in China can reduce financing constraints for the investments of private firms, while increasing the financing constraints for the investments of state and collective firms. Furthermore, we use political affiliation as the complementary classification criterion for ownership types to capture the status of a firm's government connection. Our results show that the private firms without clear political background seem to benefit more from developments than the private firms with such connection. These results suggest that the market-oriented reforms in China may reduce capital misallocation between state and non-state sectors. Lastly, in more detailed analyses, we also find that the benefits of financial development should be easier for domestic private firms to capture, once the development of the institution has reached a certain level.

In Chapter 3, we explore Q2 by using the Chinese listed firms' dataset (1998 - 2010). We build our tests on the trade-off theory of capital structure. Ideally, a value maximizing firm should borrow towards an optimal point which is defined by balancing the bankruptcy costs of debt and the tax advantages of debt (Myers, 1984). Given market imperfections, however, firms cannot always stay at their optimal leverage levels. Instead, they take positive steps to offset deviations from optimums. Empirically, the standard partial adjustment model has been widely applied to estimate the speed of leverage adjustment towards the optimal leverage (Fama and French, 2002). We firstly classify firms into different groups, according to the nature of their ultimate controller, i.e. state, non-state and private. We further classify firms in each ownership type category into high or low ownership concentration group. After that, we estimate the one-step reduced partial adjustment model (Flannery and Rangan, 2006) by using the data of firms in each category and then compare the calculated adjustment speed coefficient cross groups.

The results of sample separation tests show that SOEs present lower overall adjustment speed of leverage than private firms. The possible explanation is that the relatively low costs of adjustment due to better access to debt market may not motivate SOEs to adjust their leverage ratios towards optimal levels more actively but instead reduce the importance of eliminating deviations from optimal leverage levels in their financing

decisions. Also, we find that the firms with higher level of ownership concentration present higher leverage adjustment speed. This positive relation is stronger in POEs than in SOEs. Simply speaking, the increasing level of ownership stakes should make the benefits of approaching optimal leverage levels become larger for the non-state controlling shareholder than for the state controlling shareholder.

In Chapter 4, we explore Q3 by using the updated Chinese listed firms' dataset (1998-2016). We study the impact from short debt maturity on capital expenditures through the channel of rollover risk. We measure short debt maturity as the ratio of short-term debt to total debt and estimate a classical investment regression augmented by leverage and short debt maturity (Lang et al., 1996 and Aivazian et al., 2005b). Our results are clear. Firms invest less when they have shorter debt maturity as they face higher rollover risks. This overhang effect generated by short-term debt is more significant when firms have lower financial health since the rollover risks are likely to be more serious when firms' assets-in-place deteriorate. Besides, we find that the negative effect of shorter debt maturity on investment becomes much smaller after the year 2008 than before it. This indicates that the rollover risk faced by firms may be temporarily reduced by the injection of more long-term bank loans due to the implementation of a 4 trillion fiscal stimulus package. Lastly, we find that the investments of SOEs are negatively affected by shorter debt maturity but the corresponding marginal impact from short debt maturity on the investments of SOEs is much lower than that of non-SOEs. Therefore, to be consistent with the argument in many previous Chinese studies, we conclude that soft budget constraints may reduce the importance of financial variables for SOEs' investment decisions.

1.5 Contributions

This thesis contributes to literature in several aspects. First, using a very representative Chinese firm-level dataset, our study examines whether or not the degree of financing constraints can be associated with the cross-province differences in institutions and financial development. Many previous studies on the relation between finance and growth in China do not fully consider the fact that China is a large and diversified country with significant regional differences in institutions and financing environments (Demurger et al., 2002; Allen et al., 2005). On the aggregate level, ignoring such regional disparities can easily generate the misleading conclusion that developments of official financial sectors

are trivial for economic growth. After controlling such regional differences, however, our micro-evidence conveys a positive attitude towards the efforts taken to improve the local institution and financial market, in terms of alleviating firm-level credit constraints.

Second, we provide systematic analyses of heterogeneous leverage adjustment behaviors of firms with different ownership status. More specifically, differing from previous capital structure studies using Chinese listed firms' dataset, we consider the effects of state ownership on firms' optimal leverage converging decisions rather than on their static leverage choices in level. Also, we explore the effects of ownership concentration on firms' capital structure decisions. Contrasting with the rather diffused ownership structure of US firms, in many other developed and developing economies, ownership is commonly concentrated in hands of a few large shareholders, e.g. Western Europe (La porta et al., 1999 and Faccio and Lang, 2002) and East Asia (Claessens et al., 2000). We find that the presence of such concentrated ownership structure can result in the different dynamic capital structure decisions of Chinese firms from those of US firms.

Lastly, we extend the empirical literature on the relation between debt maturity and firm's investment decision. Using the datasets of US and UK firms, past studies find a negative coefficient on long-term debt maturity in the investment regressions (Aivazian et al., 2005b and Dang, 2011). This is consistent with the conventional argument in Myers (1977) that firms holding risky debt with longer maturity are more likely to have lower investment incentives since their shareholders are unwilling to transfer returns from projects to debtholders. In other words, firms can reduce the underinvestment issue by using more short-term debt. Nevertheless, such a working mechanism of debt maturity policy may only be valid in economies with mature capital markets in which firms largely rely on long-term debt financing. In most emerging economies, such as that of China, the high degree of asymmetric information plus a bank dominated financial system can easily result in high risk premium of the debt contract with longer maturity. Therefore, the exact positions of long-term and short-term debt in the financing decisions of Chinese firms may be different from that of US firms. Our results show a negative coefficient on short debt maturity, i.e. a positive coefficient on long-term debt maturity, in the investment regression. This indicates that the rollover risk plays a more important role than expected in shaping the real decisions of firms with heavy reliance on short-term debt financing. Our empirical results may reconcile the conflicts from the recent several theoretical works (Moyen, 2007 and Diamond and He, 2014) in predicting the overhang effects of short-term debt.

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Chapter 2
Institutions, Financial Development and Financing constraints: Micro-Evidence in China

2.1 Introduction

Financing constraints on real activities of enterprises are believed to be very present in China (Poncet et al., 2010). Lending activities are substantially controlled by the inefficient banking sector that is dominated by four state-owned banks, reducing the importance of other financing channels, such as equity, trade credit, and leasing (Ayyagari et al., 2010). Even worse, these state-owned banks prefer to offer easier credit to state enterprises while strongly discriminating against those private enterprises (Boyreau-Debray and Wei, 2005). From the World Business Environment Survey of the investment climate, over 1999–2005, 80% of private enterprises in China consider financing constraints as a major obstacle. Nevertheless, private enterprises still present high investment rates and are regarded as the engine of the fast growth of the Chinese economy.

This firm-level finance-growth puzzle motivates past literature on financing constraints to find answers from the aspect of the self-financing capability of Chinese private firms, e.g. plentiful cash flow (Guariglia et al., 2011) and efficient working capital management (Ding et al., 2013). Their results imply that private enterprises in China may not be able to sustain their high investment and growth rates once their competitive advantages used to generate high profits are eroded (Guariglia et al., 2011). Thus, to maintain the continuous prosperity of the Chinese economy, measures are required to ensure more widespread access to external finance for the private sector. One most straightforward way should be improving the financing environment through institutional and financial development.

Unfortunately, the main stream literature on the direct relationship of external financing conditions with growth in China usually suggests that the improvement of a relatively undeveloped legal and financial system should be a long-term project and its effectiveness may not be very significant in the short run (Allen et al., 2005; 2011). However, these studies often do not fully consider the fact that China is a large and diversified country with significant regional differences in institutions and financing environments (Demurger et al., 2002 and Guariglia and Poncet, 2008). For instance, each province or region in this relatively decentralized economy can be considered as an autonomous economic entity (Liu and Siu, 2006). Also, financial markets in China are severely segmented since cross-region bank lending has been relatively rare (Boyreau-Debray and Wei, 2005). It is reasonable to conjecture that the counterintuitive relationship between finance and growth

in China may not still be the case once these dramatic differences of institutions and financial development among regions are controlled.

To best of our knowledge, there is no systematic research using very representative Chinese firm-level dataset to examine whether or not the degree of financing constraints can be associated with the cross-province differences in institutions and financial development. This paper fills this gap. Specifically, we use a panel of more than 95,000 Chinese firms of different ownership types over the period 2000-2007 and estimate the linearized regression model driven from the conventional Euler equation model of investment and use the investment cash flow sensitivity to infer the degree of financing constraints faced by firms. We use the Marketization Index for China's provinces from 2000-2007, published by the National Economics Research Institute (Fan et al., 2009), to control for cross-regional differences in institutions and financial development. An interaction term between cash flow variable and marketization index is added into the regression model. If institutional and financial development can lower firm-level financing constraints by improving efficiency in the local capital markets, then the coefficient for the interaction term should be negative and statistically significant.

The basic results show that institutional and financial development in China can reduce financing constraints for the investments of private firms and partly for foreign firms, while increasing the financing constraints for the investments of state and collective firms. Using private firms as an example, we find that the firms in the provinces with average levels of development of institutions and finance, such as Anhui, Chongqing or Shandong, present an investment-cash flow sensitivity around 0.28 while this sensitivity jumps to 0.43 for the firms in the provinces with lower than average level, such as Shanxi, Yunnan or Neimenggu. These results suggest that the investments of the firms located in the regions with better institutions and financial development are less constrained by the availability of internal funds since they have better access to external financial resources. Our main conclusion remains unchanged after considering many potential issues, such as the uneven distribution of firms across provinces and industries; time variant effects of development and measurement bias on investment opportunities.

Apart from ownership types, we also use political affiliation (*Lishu*) as the complementary classification criterion to further capture the status of firms' government connections. Our results indicate that market-oriented reforms and developments in China

may reduce the degree of financing constraints more for the private firms without specific political background than the private firms with such background. Besides, our results show that large-sized private firms are more financially constrained in China. Cull et al. (2014) argue that this should be caused by the crowding out effect in external financing faced by those large firms without government connections. Motivated by this phenomenon, we further classify the large-sized private firms into groups with or without political affiliation. The results show that institutional and financial development may reduce financial obstacles for the large-sized private firms without political connections but not for the large-sized private firms affiliated with the government. These results may indicate that the crowding out effect in external financing, mainly generated by the political pecking order effects, can be gradually eliminated with the process of marketization in China.

Lastly, the marketization index contains five major sub-indices. Each of them separately measures the development of institutions or the financial market. To detect which aspect of these market-oriented reforms affect the status of financing constraints for Chinese firms most, we estimate the coefficient on the interaction between cash flow and each sub-index. Although the coefficients on all interactive terms are highly statistically significant, the absolute values of the institution related coefficients are much larger than those of the financial market related coefficients. The corresponding implication could be that the benefits of financial development should be easier for domestic private firms to fully capture once the development of institutions has reached a certain level.

The remainder of the paper is organized as follows. Section 2 provides a literature review for financing constraint. Section 3 describes our firm-level dataset and the province level marketization index. Section 4 presents the theoretical framework, empirical specifications, main hypothesis and estimation methodology. Section 5 presents our empirical results. Section 6 shows the results for robustness tests and section 7 concludes the chapter.

2.2 Literature review

2.2.1 Investment and financing constraint

In a world with perfect capital market, finance should be irrelevant for real decisions of firms as internal and external funds are perfect substitutes (Modigliani and Miller, 1958). Nevertheless, this M-M proposition has been challenged by a large amount of literature based on the assumption that external finance is more costly than internal finance since the existence of asymmetric information and agency issues causes creditors to impose a relatively high premium on non-collateral borrowing (to see: e.g. Jensen and Meckling, 1976; Mryers, 1977; Stiglitz and Weiss, 1981). Therefore, the pecking order model indicates that firms prefer to firstly choose internal funds or risk-free debt, then risky debt, and finally equity (Myers and Majluf, 1984). In other words, firms are considered to be financially constrained if their investments are limited by the availability of relatively inexpensive internal funds (Hubbard, 1998).

The empirical examination of financing constraints comes from the seminal work by Fazzari et al. (1988), who use US manufacturing firms' panel data and introduce the investment cash flow sensitivity (ICFS) as a measure of the degree of financing constraints after controlling for the investment opportunity by using average q. They split the sample into 'financially constrained' and 'unconstrained' firms, according to the different levels of dividend pay-out ratios, arguing that firms facing a high cost premium for external finance tend to choose a low dividend pay-out ratio since they have to retain more internal funds for future investment. Their results indicate that financially constrained firms have higher ICFS than that of unconstrained firms.

Many subsequent studies largely support the results from Fazzari et al. (1988). For example, Devereux and Schianterelli (1989) use the data of manufacturing firms in the United Kingdom to estimate the modified Q based investment model and find that cash flow matters more for young firms, since their information asymmetries are likely to be larger and they need to finance a higher level of investment rate. Similarly, Hoshi et al. (1991) detect that the bank tied firms in Japan tend to present lower ICFS than that of the independent firms. This indicates that a close bank relationship is likely to mitigate information problems in the process of seeking external finance for corporate investments.

Nevertheless, several apparent limitations of the framework used by Fazzari et al. (1988) have aroused heated debate on the validity of ICFS as a measurement of the degree of financing constraints. First, cash flow may capture the investment opportunities that average Q fails to capture (Alti, 2003). Theoretically, very strict assumptions are required to equalize marginal Q and average Q (Hayashi, 1982) which can be easily violated if firms have market power (Cooper and Ejarque, 2003). Empirically, noisy share prices can generate measurement errors in average Q (Erickson and Whited, 2000). These systematic problems shift the explanatory power away from fundamental terms, i.e. Tobin's Q, towards cash flow, hence showing spurious conclusion of financing constraints (Gilchrist and Himmelberg, 1995).

Second, Kaplan and Zingales (hereafter KZ, 1997) argue that dividend pay-out ratios may be endogenous with investment decisions and tend to classify firms incorrectly. They combine the qualitative and quantitative information from firms' annual reports and reclassify the 49 financially constrained firms defined by Fazzari et al. (1988) and find that ICFS is actually lowest for the most constrained firms. The reconciliation of this debate is provided by Cleary et al. (2007) who argue that the opposite results from those of Fazzari et al. (1988) and KZ (1997) can be obtained by using the same dataset but with different sample classification methods. If firms are classified on the basis of their internal funds, U-shaped ICFS will be obtained, e.g. as in KZ (1997) and Cleary (1999). If firms are classified on the basis of indicators of the degree of asymmetric information in the capital markets, the results are consistent with Fazzari et al. (1988). This inference is further confirmed by the empirical work from Guariglia (2008) using a UK unlisted firm-level dataset.

For Chinese unlisted firms, Cull et al. (2015) argue that ICFS is a valid measurement of the degree of financing constraints. In this Chapter, we use political and institutional related factors to do *a priori* classification of firms. As mentioned by Ayyagari et al. (2010), government connection can help Chinese firms to obtain bank loans. Institutional factors are similar to business groups in which members have lower ICFS than non-members (Hoshi et al., 1991). The variations of these factors are less likely to be affected by the variations in firms' financial conditions. Furthermore, financing constraints should be more present in an economy with a relatively undeveloped capital market. Specifically, Moshirian and Vadilyev (2013) find that the ICFS is more pronounced in emerging

markets than in those of developed countries. It is a well-known fact that China is the biggest developing country with a relatively poor financial system (World Bank, 2013).

2.2.2 Financial development and financing constraint

If financial development can improve the efficiency of the financial market, such as reducing transaction costs, optimizing capital allocation and enhancing monitoring, then the degree of financing constraint faced by firms should be reduced as well. The within country studies tend to treat developing countries as the natural experimental samples in which financial liberalizations are usually taken to improve the efficiency of an immature financial system. For instance, Harris et al. (1994) find that the market-oriented financial liberalization in Indonesia increased borrowing costs but widened access to external finance for smaller firms. The net effect appears to have been positive. Gallego and Loayza (2000) report that the investment of firms became less sensitive to cash flow or debt but more sensitive to Tobin's Q after financial liberalization in Chile. Gelos and Werner (2002) use Mexican data to estimate a simple accelerator model with cash flow variable. They find that the ICFS is higher for smaller firms and decreases significantly after financial liberalization. Nevertheless, the indicator of financial liberalization is just a time dummy in the regression model, so the effects from financial liberalization on financing constraints are usually difficult to separate from the effects of changes in business cycles. Also, financial reforms may not be able to benefit firms immediately but need a certain level of financial infrastructure to be reached in the economy.

To overcome these potential problems, another group of studies attempts to measure the level of financial development more directly and compare the behaviours of firms across countries with different levels of financial developments. Specifically, Love (2003) uses cash stock to parameterize the stochastic discount factor of managers within a structural framework and finds that high financial development and legal efficiency can dramatically reduce the cost of capital for firms, especially for smaller firms. Using the same method, Harrison et al. (2004) find that the increase of FDI can also lower firm-level financing constraints. Laeven (2003) constructs a cross-country comparable time varying index for financial liberalization and creates an interaction between it and cash flow variable in the investment regression. The results show that higher level of financial liberalization can reduce the degree of financial constraints for smaller firms but increase the financing constraints for larger firms.

2.2.3 Institutional effects

Discussion of the effects of institutional factors on financing constraint starts with the relationship between institutions and financial development. Generally speaking, finance is a set of contracts which are closely related to legal rights and enforcement mechanisms. A well-functioning institutional system should be able to facilitate the operation of both markets and intermediaries (Beck et al., 2003b; 2005b). One growing group of studies examines the effects of laws and regulations on the operations of the financial sector. For example, La Porta et al. (2000) argue that the differences in legal institutions are fundamental sources of international differences in financial development. Levine et al. (1997; 1998) show that the laws and enforcement mechanisms which protect the rights of outside investors tend to foster financial development.

Several studies have investigated the effects of institutional changes on the real side of the economy by using firm-level datasets. For example, Demirguc-Kunt and Maksimovic (1998) find that a greater proportion of firms use long-term external financing in countries with more efficient legal systems. This is because an effective legal system can better protect the interest of creditors by deterring violations and enforcing compensation for infractions. Using a cross-country firm-level survey dataset, Beck et al. (2005) argue that institutional development can reduce the constraining effects of financial, legal, and corruption obstacles especially for the growth of small firms. In addition, political institutions have been shown to have strong power in shaping the design and the operations of corporations, credit and securities markets in a centralized economy (Byod and Smith, 1996; Pagano and Volpin, 2002 and Haber, 2004).[15] For instance, Bertrand et al. (2007) document sharp changes in capital structure and bank lending decisions after the elimination of government intervention in the banking industry in France in 1985. Their results indicate that, after the reform, banks improved their monitoring and screening functions and the cost of capital was increased significantly for worse performing firms.

[15] E.g. the level of market interest rates, the existence of various taxes, and of various subsidies, are all factors that can determine the cost of external funds.

2.2.4 Financing constraints in China

Most empirical literature on financial constraints in China follows the ICFS framework. Chow and Fung (1998) firstly confirm the existence of lending bias in the manufacturing sector of Shanghai. They find that the investments of private enterprises are more sensitive to the availability of cash flow than those of state-owned enterprises. Meanwhile, international joint ventures are the least constrained in terms of liquidity. Using the same dataset and a very similar method, Chow and Fung (2000) detect a counter intuitive relationship between firm size and liquidity constraints for those manufacturing firms, i.e. larger firms present higher ICFS than smaller firms. They attribute this finding to some institutional features that are common among transition economies. Chen (2008) uses the Chinese listed firm-level dataset and finds that non-state firms located in the central regions suffer the strongest financial constraints. Hericourt and Poncet (2009) and Poncet (2010) use the firm-level survey data conducted by the World Bank and large manufacturing firm-level data from the Oriana dataset, respectively, and find similar results: the decline of the state economic predominance and the increase of liberalization to foreign capital can reduce dependence of investment on internal funds for private firms. Furthermore, using listed firms' dataset, Chan et al. (2012) find that the firms with a politically connected CEO or Chair display no financing constraints whereas the firms without such connection experience significant constraints. Besides, Cull et al. (2015) use survey data to construct proxies for the relative severity of information and liquidity problems faced by the Chinese manufacturing firms. Their results indicate that the firms with higher perceived financial obstacles by managers indeed present higher level of ICFS.

Based on the assumption that financing constraint is present in China (Allen et al., 2005), the sensitivity of firms' real decisions to changes in financial variables is often interpreted as the evidence that firms use the corresponding financing channels to overcome financing constraints and maintain high growth rates. In detail, Long and Zhang (2011) argue that smaller firms located in the areas with industrial clusters are more likely to use trade credit to mitigate financial obstacles.[16] Guariglia et al. (2011) connect the private enterprises' remarkable assets growth with their amazing ability to generate abundant internal funds, e.g. cash flow. More recently, Ding et al. (2013) find that the effective management of working capital can help Chinese private firms to alleviate credit constraints by mitigating the negative shock in cash flow. These studies may also leave an

[16] In detail, Cull et al. (2009) find that trade credit does not play a significant role in firm performance among Chinese firms.

impression that the financial environment in China is too poor to support the growth of non-state firms.

Although China is usually considered as a counter intuitive case in the finance-growth literature, several studies in the last decade provide somewhat positive assessments for the development of Chinese financial system from different aspects. For instance, one direct examination of the relationship between China's financial development and its economic growth is conducted by Guariglia and Poncet (2008) who find that market driven financing in the economy tends to promote GDP and TFP growth at province-level. Also, Ayyagari et al. (2010) argue that the undeveloped formal financial system is still more important than informal financing channels for the fast growth of private enterprises. Besides, Chong et al. (2013) find that increased competition in the banking market and lower market concentration in the banking industry can alleviate financing constraints for small and medium sized firms in China. However, these studies often do not consider the full scope of financial development and may suffer also from a sample representative problem.[17]

Lastly, some studies consider the institutional effects on firm performance in China but most of them only concentrate on the role of government in exerting political power on the economy. Tan (2007) argues that soft budget constraint is usually regarded as the most direct benefit from building institutional ties with governments in China, even for private firms. Nevertheless, Li (2004) finds that the positive effects should be U-shaped as the middle-level local governments usually do not have the superior access to resources of the central government and they also do not have the incentives to do 'mirco-management' for firms as the lowest-level local governments do. Besides, Li et al. (2008) find that political connections afford more confidence for private enterprise in the Chinese legal system. Overall, government connection can be a 'double-edged sword'. The obtained priority in capital or product market may help firms overcome the frictions caused by undeveloped legal and financial systems. However, these benefits may be at the expense of future long-run growth of the firms or even that of the whole economy. We further discuss this issue in the next section.

[17] For example, Chong et al. (2013) have used the survey dataset containing 4300 SMEs only.

2.3 Data

2.3.1 Firm-level dataset

We use data drawn from the annual accounting reports filed by industrial firms with the National Bureau of Statistics of China (NBS) over the period 2000-2007. All firms with annual sales of five million yuan (about $650,000) or more are covered. These firms operate in the manufacturing and mining sectors and come from 30 provinces or province-equivalent municipal cities. We exclude observations with negative values of sales; total assets minus total fixed assets; total assets minus liquid assets and accumulated depreciation minus current depreciation. In addition, we exclude observations with the ratio of fixed investment to capital stock larger than one and observations with the ratio of sales to capital stock greater than 3. We also exclude the firms without complete records on our main regression variables. To control for the potential influence of outliers, we exclude observations in the one percent tails of each of the regression variables. Finally, in order to perform first-differenced GMM, we exclude all firms with less than 4 years of consecutive observations. Our final panel covers 94,673 mainly unlisted firms, which corresponds to 538,207 firm-year observations. It is unbalanced, with number of observations ranging from a Minimum of 36,697 in year 2000 to a maximum of 85,448 in 2003. In columns (1), (2) and (3) of Table 2.1, at province (region)-level, we present the average firm-level variables used for estimation.

2.3.2 Proxy for institutions and financial development

In this paper, we use the Marketization index for China's provinces from 2000-2007, published by the National Economics Research Institute (NERI) (Fan et al., 2009), to proxy the Province-level institutions and financial development in China. The index uses a zero to ten score system to measure the relative progress in marketization of China's 31 provinces (including five autonomous minority ethnic regions and three municipalities directly under the control of the central administration)[18]. Marketization is assessed in five fields: Government-market relations; Development of the non-state enterprise sector; Development of the commodity market; Development of factor markets and Intermediate/ legal framework. Data are either from statistics or enterprise and household surveys.

[18] In this paper, we have only used the index for 30 regions, since our firm-level dataset does not contain the information from the province Xizang (Tibet).

Table 2.1 Descriptive statistics for key variables

	CFK (1)		IK (2)		SRK (3)		Index (4)	Sample size (5)	
	Mean	*Std*	*Mean*	*Std*	*Mean*	*Std*	*Average*	*Obs.*	*Firms*
Guangdong	0.28	0.35	0.09	0.39	5.82	5.25	1.96	63540	11022
Zhejiang	0.29	0.30	0.13	0.35	5.98	4.73	1.94	86789	15194
Shanghai	0.36	0.44	0.10	0.31	5.61	4.91	1.92	32922	5515
Jiangsu	0.28	0.33	0.10	0.36	6.57	5.30	1.40	70374	12314
Fujian	0.30	0.36	0.10	0.36	5.57	5.06	1.31	28446	4889
Tianjin	0.30	0.43	0.08	0.35	5.15	4.95	0.97	11005	1841
Beijing	0.24	0.37	0.10	0.31	4.37	4.60	0.93	12146	2038
Shandong	0.32	0.39	0.09	0.40	5.47	5.04	0.69	43391	7723
Liaoning	0.21	0.34	0.08	0.38	4.32	4.40	0.53	19262	3403
Chongqing	0.23	0.34	0.10	0.33	4.52	4.37	0.36	6975	1216
Sichuan	0.21	0.31	0.08	0.37	4.47	4.51	0.07	16352	2840
Anhui	0.18	0.28	0.09	0.38	4.43	4.31	-0.03	11982	2190
Hebei	0.28	0.40	0.07	0.37	4.60	4.67	-0.05	22328	3929
Hubei	0.20	0.31	0.06	0.43	4.71	4.69	-0.16	12025	2260
Hainan	0.18	0.36	0.02	0.39	3.34	3.95	-0.24	1266	224

IK = Investment/Capital Stock; SRK = Sales/Capital Stock; CFK = Cash flow/Capital Stock;
Market = Marketization Index measures development in institutions and finance in each province.
To be continued on the next page.

Table 2.1 (continued) Descriptive statistics for key variables

	CFK (1)		IK (2)		SRK (3)		Index (4)	Sample size (5)	
	Mean	*Std*	*Mean*	*Std*	*Mean*	*Std*	*Average*	*Obs.*	*Firms*
Henan	0.35	0.45	0.08	0.38	5.21	4.89	-0.27	21761	3995
Hunan	0.26	0.37	0.08	0.45	4.96	4.77	-0.28	13045	2562
Jiangxi	0.18	0.30	0.05	0.42	4.14	4.58	-0.30	5993	1132
Jilin	0.17	0.30	0.06	0.40	3.27	3.86	-0.44	5841	1050
Guangxi	0.15	0.29	0.05	0.35	3.55	4.19	-0.45	6927	1256
Neimenggu	0.22	0.35	0.08	0.35	3.93	4.14	-0.67	3824	688
Heilongjiang	0.15	0.29	0.07	0.35	3.19	3.71	-0.68	5506	1013
Yunnan	0.17	0.29	0.05	0.31	2.81	3.23	-0.76	6282	1036
Shanxi	0.13	0.24	0.11	0.35	2.54	3.08	-0.76	9490	1688
Shaanxi	0.13	0.29	0.05	0.36	2.86	3.38	-1.01	6867	1191
Xinjiang	0.16	0.29	0.07	0.33	2.59	3.07	-1.04	3360	596
Ningxia	0.15	0.25	0.09	0.32	2.78	3.12	-1.07	1200	215
Gansu	0.11	0.23	0.03	0.40	2.99	3.86	-1.08	3399	621
Guizhou	0.12	0.30	0.06	0.35	2.97	3.65	-1.14	5152	894
Qinghai	0.13	0.27	0.04	0.42	2.16	2.85	-1.67	757	138
Mean	0.22		0.08		4.16		0.00		
Std.	0.07		0.02		1.17		0.98		
Total								538207	94673

IK = Investment/Capital Stock; SRK = Sales/Capital Stock; CFK = Cash flow/Capital Stock;
Market = Marketization Index measures development in institutions and finance in each province.

We are motivated by the following reasons to use the marketization index as proxy to institutions and financial environment in China. First, the financial market development sub-index directly measures the share of non-state financial institutions in total deposits and the share of bank loans credited to non-state enterprises. In the cross-country studies on the finance-growth relationship, these two share factors are widely used as indicators to measure the level of financial development (see: e.g. King and Levine, 1993a; Love, 2003; Levine, 2006). In the Chinese financial system, bank loan is the major official financing resource. For example, in a province, if its banking sector offers a share of total credits to private sectors larger than the average value of this share across all provinces, then the privately owned firms in this province should face lower than average level of constraints in terms of bank loan borrowing. Furthermore, banking industry is controlled by the state. The higher share of non-state financial institutions in total deposits not only means the higher competition within the banking industry but also means higher competition in the whole local capital market. Therefore, it is reasonable to say that the regions with higher values of these two factors can have better financing conditions.[19]

Second, the marketization index effectively measures the development of institutions that closely relate to the efficiency of resource allocation in China's capital market. Specifically, the Chinese government has played a much greater role in China's transition than other Asian countries' governments have in their transitions (Lu et al., 2014). The capitalization of political power and social relationship give the people who participate in those relationships greater negotiating power in the market. Therefore, firms with these relationship based advantages can easily take control of market mechanisms. Nevertheless, Kranton (1996) argues that the specialized markets will remain thin and the search costs will remain high if relationship-based transactions make up the majority of economic transitions in society. This indicates that benefits from a relationship-based system do not come without cost. In the long-term, this system continuously imposes a high cost on public transactions and aggravates the misallocation of resource in the capital market, which will in turn restrict the growth of the Chinese economy (Li, 2000). Therefore, the core of economic reforms in China aims at gradually separating the political sector from the business sector. A province or region with a lower level of crowded state-owned capital as well as lower level of government intervention tends to have a more active local

[19] Although banks in China can technically finance across provincial lines, the majority of their activities take place within provinces (Guariglia and Poncet, 2008). For instance, a positive and significant correlation between provincial bank deposits and loans was detected by the World Bank (2005) report on market integration in China.

financial market where local firms are more likely to compete fairly for credits at market price. The NERI marketization index has explicitly recorded the evolving government-market relationship and reduction (or growth) of state (or non-state) enterprise sector in each region.[20]

Lastly, the marketization index also records the development of legal environment for business, which is regarded as one of the most important aspects of institutions determining financial development in previous cross-country studies. A better legal environment for businesses should be able to enhance the confidence of creditors in signing contracts with private enterprises that do not have political backup. Overall, the marketization index is expected be better than the single index of financial development at capturing the outside financing environment for enterprises in China. Given the close relation between institutions and finance in the Chinese economy, we prefer to mainly rely on the weighted overall index in the analyses.

In column (4) of Table 2.1, we present the province-level average marketization index and rank it in descending order. Geographically, the provinces in the coastal region have the most developed economies while those in the western region suffer most from under development. The situations of the provinces in the central area lie between that of the western and coastal areas. The cross-province distribution of the index largely captures this feature of the Chinese economy.[21] For instance, the standardized marketization index varies dramatically from the most developed eastern province Guangdong (1.96) to the least developed western province Qinghai (-1.67).

In Appendix A, we also present the province-level average values of the five standardized sub-indices of the marketization index in Table A.14. When we compare the values of the overall index with the values of each sub-index across regions, there is an obvious information overlap. In other words, the provinces with higher values in the overall index also tend to present higher scores in most sub-categories. Nevertheless, this does not necessarily mean that the specific rankings of provinces remain the same across

[20] The Chinese government tends to subsidise these state-owned firms. State-owned banks prefer to provide easy credit to government-related firms. Once the amount of state capitals decreases dramatically in a province or region, it is reasonable to believe that credits previously crowded to support inefficient as well as unprofitable state-owned firms will flow into fast growing and efficient private sectors. In other words, the degree of external financing constraints for those firms will finally be reduced.

[21] China's openness reform proposed by Xiaoping Deng in 1980s, leading to the unbalanced economic development among coastal, central and western areas, which results in the serious provincial segmentation of both product and financial markets in the Chinese economy.

all sub-indices. For example, Tianjin is a relatively extreme case. It has a sub-index value measuring the development of the local financial market equal to 1.43, ranked as No.2 in this category, but a sub-index value measuring the degree of separation between government and business equal to 0.13, ranked as No.13 in this category. Therefore, except for the overall index, we will also consider the potential differential impacts from different sub-indices on firm-level financing constraint.

2.4 Empirical specifications

2.4.1 Investment model and financing constraint test

The Euler equation investment model is widely used in studies of financing constraints and investment (see: e.g. Whited, 1992; Bond and Meghir, 1994; Love 2003). There are at least two advantages for us to choose the Euler equation investment model as our benchmark. First, this method avoids the use of noisy share price data. Theoretically, Tobin's Q contains all the relative information of future profitability for investment (Tobin, 1969). As the unobservable Q should summarize expected future value of a firm, many researchers use the price from forward looking markets (e.g. stock markets) to calculate the average q. Unfortunately, the applications of average q are proved disappointing. The investment regression fits poorly and leaves large residuals correlated with cash flow (Hassett and Hubbard, 1997 and Caballero, 1999). Besides, our Chinese dataset contains mainly unlisted firms who do not have market information. It is impossible for us to construct the average q based on market evaluation. The Euler equation implicitly incorporates the optimal investment path into every pair of optimal inter-temporal investment decision. There is no necessity for us to pursuit a Q analogous summation of discounted future values. Second, the effects from liquidity constraints can be conveniently modelled within the Euler framework. Previous studies often use a reduced form of the Q based regression model and add cash flow term intuitively into the model without any theoretical justification.[22] With measurement error in average q, the interpretation of the cash flow coefficient becomes even more problematic. In contrast, the presence of cash flow in the linearized Euler equation comes from a structural framework associated with liquidity constraints. Therefore, our ICFS interpretation should be more convincing and

[22] Similar issue exists in accelerator model and error correction model.

suffer less from mismeasurement of investment opportunities. We introduce this model in the latter part of this section.

In this chapter, we closely follow the specification in Laeven (2003) and firstly assume that the firm value is given by:

$$V_t(K_{t-1}) = \max E_t \left[\sum_{j=0}^{\infty} \beta_{t+j}^{t} D_{t+j} \right] \tag{2.1}$$

subject to:

$$D_t = \Pi_t + B_t - (1 + r_{t-1}) B_{t-1} \tag{2.2}$$

$$K_t = (1 - \delta) K_{t-1} + I_t \tag{2.3}$$

$$D_t \geq 0 \tag{2.4}$$

where D_t is the dividend pay-out, $\Pi_t = \Pi(K_t, L_t, I_t)$ is the profit function, δ is the time invariant depreciation rate. The evolution procedure of capital stock K_t does not incorporate the 'time to build' assumption and assumes that the fixed investment I_t becomes productive immediately (Gilchrist and Himmelberg, 1995). Also, B_{t-1} is the long-term debt, r_{t-1} is the interest rate equal to the risk-free interest rate, E_t is the expectation operator conditional on time t information set,

$$\beta_{t+j}^{t} = \prod_{i=1}^{j} (1 + r_{t+i-1})^{-1} \tag{2.5}.$$

The j-period discount factor for $j \geq 1$, and $\beta_t^t = 1$. Following Whited (1992), let λ_t be the Lagrange multiplier for the non-negativity constraint on dividends (2.4). This multiplier can be interpreted as the shadow cost of external financing. Combining the first-order condition for the end of period K_t in equation (2.1) with the envelope condition and rearranging, we can obtain the standard Euler equation:

$$\left(\frac{\partial \pi_t}{\partial I_t}\right) + (1 + \lambda_t)\left(\frac{\partial \pi_t}{\partial K_t}\right) = (1 - \delta)\beta_{t+1} E_t \left[(1 + \lambda_{t+1})\left(\frac{\partial \pi_{t+1}}{\partial I_{t+1}}\right) \right] \tag{2.6}$$

This expression indicates that the marginal profits generated by investing today plus the marginal profits of capital should be equal to the discounted marginal profits generated by investing tomorrow. If the former term is smaller than the latter term, then the firm will prefer to invest tomorrow rather than today, and *vice versa*. In the Q model, the marginal q covers the expectation of future profitability in each subsequent period. In the Euler equation, however, this integral governance is split into the optimal inter-temporal investment decisions determined by the one-step ahead forecast of discounted marginal product of investment.

The first-order condition for debt equals:

$$1 + \lambda_t = E_t\left[(1 + \lambda_{t+1})\left(1 + \eta_t + \frac{\partial \eta_t}{\partial B_t} B_t\right)\right] \tag{2.7}$$

which indicates that the marginal cost of external funds determines the relationship between λ_t and λ_{t+1}. If $D_t > 0$, sufficient internal funds are available for investment and a part of rest earnings can be used to pay positive dividends. In this situation, the Lagrange multiplier λ_t should be zero as the shadow value of internal funds is negligible.

To obtain the empirical regression model of investment from equation (2.6), several assumptions have to be imposed. First, Bond and Meghir (1994) define the net revenue function as:

$$\Pi_t = p_t F(K_t, L_t) - p_t G(I_t, K_t) - p_t^I I_t \tag{2.8}$$

where $F(K_t, L_t)$ is a constant returns to scale production function, p_t is the price of output, p_t^I is the price of investment goods, $G(I_t, K_t)$ is the standard convex adjustment cost function (Summers, 1981):

$$G(I_t, K_t) = \frac{\alpha}{2}\left(\frac{I_t}{K_t} - c\right)^2 K_t \tag{2.9}$$

Second, to allow for imperfect competition, we assume that p_t is the function of output $Y_t = F_t - G_t$ which is homogeneous in both K_t and L_t and donate the constant price

elasticity of demand $\varepsilon > 1$. Given these assumptions, setting $\lambda_t = \lambda_{t+1}$, the empirical Euler investment equation without financing constraints is:

$$\left(\frac{I}{K}\right)_{t+1} = c(1-\theta_{t+1}) + (1+c)\theta_{t+1}\left(\frac{I}{K}\right)_t - \theta_{t+1}\left(\frac{I}{K}\right)_t^2 + \frac{\theta_{t+1}}{a(\varepsilon-1)}\left(\frac{Y}{K}\right)_t - \frac{\theta_{t+1}}{a\gamma}\left(\frac{GP}{K}\right)_t + \frac{\theta_{t+1}}{a\gamma}J_t + u_{t+1} \quad (2.10)$$

where $\theta_{t+1} = (1+\rho_{t+1})/(1-\delta), \rho_{t+1} = (1+ r_{t+1})(p_t/p_{t+1}) - 1$ is the real discount rate, $\mathrm{GP} = \mathrm{p_t Y_t} - \mathrm{w_t L_t}$ is the gross profit which can be replaced by the cash flow variable, $\mathrm{J_{it}} = (\mathrm{p_t^I}/\mathrm{p_t})(1 - \mathrm{p_{t+1}^I}(1-\delta)/(1+r_t)\mathrm{p_t^I})$ is the user cost of capital which can be captured by including time and firm specific effects, the output Y_t can be replaced by real sales,[23] $\gamma = 1 - (1/\varepsilon) > 0$ and u_{t+1} reflects forecast errors. Using firm-level panel dataset, we rewrite equation (2.10) in the panel style:

$$\left(\frac{I}{K}\right)_{i,t} = \beta_1\left(\frac{I}{K}\right)_{i,t-1} + \beta_2\left(\frac{I}{K}\right)_{i,t-1}^2 + \beta_3\left(\frac{Sale}{K}\right)_{i,t-1} + \beta_4\left(\frac{CF}{K}\right)_{i,t-1} + f_i + T_t + d_j + T_t * d_j + u_{i,t}. \quad (2.11)$$

The theoretical model behind equation (2.11) implies that the coefficient β_4 should be negative, under the assumption that the firm can raise as much finance as it desires at an endurable cost. If this assumption is incorrect then the cash flow term may reflect liquidity constraints and β_4 should be positive. To further control the investment opportunities as well as making the interpretation to the ICFS more robust, we also include the industry factor d_j interacted with year dummy T_t to capture the shifts or expectations of investment demand (Carpenter and Petersen, 2002).[24] Therefore, in the presence of market frictions, the larger the positive value of β_4 is, the higher the degree of financing constraints faced by firms should be.

[23] Under perfect competition, the elasticity of demand goes to infinity and the output term is eliminated from the Euler investment regression model. In contrast, when the competition is imperfect, the coefficient on this term is positive as $1 < \varepsilon < \infty$.

[24] Firms are allocated to one of the following nine industrial sectors: Metals and metal goods; Other minerals and mineral products; Chemicals and man-made fibres; Mechanical engineering; Electrical and instrument engineering; Motor vehicles and parts, and other transport equipment; Food, drink and tobacco; Textiles, clothing, leather and footwear; Others (Blundell et al., 1992).

Although tests in using Euler equation for financial market imperfections have many benefits, they also have several drawbacks. The theoretical model rests on several simplifying assumptions, e.g. smooth differentiable production function and adjustment technologies, capital homogeneity, within period delivery lags, and perfect capital market (Whited, 1992). The violation to any of these assumptions may result in rejection to the model. Nevertheless, we are only interested in the overall excessive sensitivity of investment to financial variables here. Therefore, instead of doing structural estimation to the parameters contained in framework (2.6), we choose to directly estimate the coefficients comprised by those parameters in a linearized regression (2.10). Although this can help us to mitigate the problem caused by the fragility of Euler equation to some extent, it on the other hand generates new misspecification problems in the estimation. Intuitively, the violation to those theoretical settings can be repacked as the inappropriate measurement of investment opportunities in the empirical regression. This is the major reason for us to further include industry dummies, year fixed effects and the interaction term between them in equation (2.11). We expect that such treatment can at least reduce the mismeasurement problem which may cause spurious positive relation between investment and cash flow variable. Furthermore, the Euler equation estimates tend to have poor small-sample properties in a time series context (Fuhrer et al., 1993; West and Wilcox, 1993 and Oliner et al., 1993). In our specification, however, we mainly relay on the cross-sectional variation rather than the within firm variation. Besides, Euler equation merely imposes inter-temporal restriction obtained from the first order conditions. It may fail to detect capital market imperfections for agents whose overall level of investment is limited by capital market frictions, but who are more constrained today than they expected to be tomorrow (Zelds, 1989; Attanasio, 1994 and Bond et al., 2003). We indirectly address such problem by doing sample classification analyses. For instance, private firms are believed to be overall more financially constrained that state firms. Lastly, the most counter-intuitive implication from linearized Euler equation of investment (2.10) is the negative relation from internal funds to investment expenditures. Although Euler equation of investment is more likely to hold when the firms are in the regime without liquidity constraints (Bond and Meghir, 1994), it should at most present a statistically insignificant coefficient on cash flow variable, according to the implication from the standard pecking order theory, rather than a negative one. Unfortunately, it is difficult for us to directly solve this theoretical limitation here. Instead, we choose to do a robustness test in section 2.6.4 of this chapter by estimating another sort of investment regression, i.e. accelerator model. If the results are

consistent with our major inference, then this artificial negative sign of cash flow variable should not impose strong effects on our application of Euler equation of investment.

2.4.2 Regional developments and financing constraints

To test the effects of institutional and financial development on firm-level financing constraint, we follow Laeven (2003) and use cash flow variable to interact with the index *D* which measures the level of development in the equation (2.11). **Basic Inference:** *If higher level of institutions and financial development can lower financing constraints for the investment of firms, then coefficient* β_5 *should be negative and statistically significant.* The intuition is that the dependence of investment on internal funds will be reduced given lower constraints in external financing.

$$\left(\frac{I}{K}\right)_{i,t} = \beta_1 \left(\frac{I}{K}\right)_{i,t-1} + \beta_2 \left(\frac{I}{K}\right)^2_{i,t-1} + \beta_3 \left(\frac{Sale}{K}\right)_{i,t-1} + \beta_4 \left(\frac{CF}{K}\right)_{i,t-1} + \boldsymbol{\beta_5} \left(\frac{CF}{K}\right)_{i,t-1} * D + \beta_6 * D + f_i + T_t + d_j + T_t * d_j + u_{i,t}. \tag{2.12}$$

Following Love (2003), we normalize the province-level marketization index over our sample period with mean zero and standard deviation one. In equation (2.12), $\boldsymbol{D}$ **is redefined as** $\boldsymbol{D_P}$, a time-invariant indicator of province-level institutions and financial development. The implicit assumption is that the level of institutions and the level of financial development are relatively constant. Although this is a strict assumption, the setting itself should be reasonable. First, our estimation period contains only six years data from 2002 to 2007.[25] The benefits from reforms may require a few more years for firms to capture, as they need a certain level of financial infrastructure to be reached. Second, the dataset used for estimation is very unbalanced with a large proportion of entry and exit. Both newly established firms and firms near bankruptcy are likely to be seriously financially constrained. If a province at one year presents a large number of new firms, for example, then the actual effects of development on firm-level financing constraints can be weakened or even be twisted in the estimation. Besides, many overwhelming changes to the Chinese institutions and financial markets, such as the stock market establishment in

[25] To keep our final dataset as representative as possible, we maintain the firms with 4 years consecutive observations. After sacrificing two years observations as instruments, the actual time length used in estimation is just two years for these firms. Comparing the time effects of development on these firms should not be as meaningful as comparing the cross-sectional effects.

1990s, as well as the restructuring of the economy, such as the reform and opening up in 1987, were already in operation for many years before 2002. This indicates that the disparities of the regional developments among different provinces should be relatively stable over our short sample period. Lastly, due to the regional policy shock or measurement errors, indices in some provinces vary strangely between two adjacent years, i.e. either change dramatically or are unchanged. These outliers may seriously affect the stability of our regression coefficients. Therefore, we prefer to put more weight on the cross-province variations of institutions and financial development rather than on their time variations.[26]

2.4.3 Ownership structure and political affiliation

Analysing the differential effects of institutional and financial development on firms with different characteristics should help us understand the working mechanisms behind the reduction effects of those developments on firm-level financing constraints. For example, we can firstly classify firms into different groups in which firms should face different costs of external funds. The group of firms having relatively high costs of external financing should present higher ICFS. In this chapter, we focus on firms' government connection. The intuition is straightforward. If developments in institutions and financial markets can separate political intervention from business sectors and create a more active as well as a competitive financing environment for all firms, then we shall see that the initially more financially constrained firms present more significant reduction in ICFS since they are likely to benefit more from developments. The main working hypotheses and corresponding justifications are presented below.

First, we use ownership structures as proxy for firms' government connections. The NBS data contains a continuous measure of ownership, which is based on the fraction of paid-in-capital contributed by six different types of investors, namely: the state; foreign investors; investors from Hong Kong, Macao, and Taiwan; legal entities; individuals; and collective investors. Following Guariglia et al. (2011) and Ding et al. (2013), we group all non-domestic investors into a single category labelled 'foreign'; and all firms owned by legal entities, and individuals into a single category labelled 'private'. We then classified our firms into 'state owned', 'foreign', 'private', and 'collective',[27] based on the majority

[26] The time variant property of marketization has been considered in our robustness test.
[27] Collective firm is usually controlled by local governments.

average shares of paid-in-capital contributed by our four types of investors in each year (Ayyagari et al., 2010).

As what have been discussed in section 4.2 of this chapter, the intrinsic feature of marketization reflects that either the development of financial market or the evolution of institutional and legal systems in China is in fact aiming at diminishing the dominant role previously played by state-owned and government related sectors. In terms of financing constraints, the overwhelming political intervention results in the well-known 'political pecking order effect', which is usually regarded as an important cause of the serious discrimination against privately owned enterprises in the domestic capital market since governments prefer to channel a large amount of credit into those inefficient firms that have mutual benefits with governments. Nevertheless, in the regions with higher level of marketization, state-owned firms are required to demonstrate behaviour that is more market-oriented. For instance, further separation between government and business should reduce both direct subsidises from government and easy credits from state-owned banks, which in turn constrains the budget of state-owned firms and forces them to use resources more efficiently.

In terms of the non-state sector, however, institutional and financial development should be able to loosen their tight budget constraints by offering better external financing conditions. First, geographical or sectoral presence of state firms aggravates financing constraints for Chinese private firms (Poncet et al., 2010). Regional marketization can significantly reduce the amount as well as the intensity of state owned capital in the local economy. Second, the higher level of financial openness stimulates the development of non-bank financing channels, e.g. private equity and venture capital. Better legal protection for investors can also encourage creditors to sign long-term contracts with private borrowers. Therefore, it is reasonable to believe that the institutional and financial development measured by the marketization index can reduce the level of external financing constraints for those non-state owned firms, especially for private firms.[28]

Hypothesis I: *If institutional and financial development can reduce external credit constraints for non-state owned firms but increase the financing constraints for state*

[28] This is the main reason for us to firstly use ownership structure to classify firms and to do sample separation tests for the effect of institutional and financial development on financing constraints. When we estimate the model (2.12) using the full sample, the interaction coefficient becomes statistically insignificant, simply because the state and non-state firms tend to have very different characteristics in financial activities.

owned firms, in the sample separation tests by ownerships we shall see that coefficient β_5 *in model (2.12) is* ***negative*** *for private and foreign firms but* ***positive*** *for state and collective firms.*

The other variable used in this chapter measuring firms' government connection is political affiliation (*Lishu*). This is a proxy for the involvement of governments at different levels in firms' operations; government functions include offering credit guarantees and political protection in return for 'administrative fees' (Huang, 2003).[29] We classify firms into two groups: the firms with and without political affiliations. Differently from ownership structures, we are unwilling to treat political affiliation as a fixed and time invariant factor. Instead, we prefer to classify firm-year observations into those that are politically affiliated and those that are unaffiliated within a specific ownership subsample:

$$\left(\frac{I}{K}\right)_{i,t} = \beta_1 \left(\frac{I}{K}\right)_{i,t-1} + \beta_2 \left(\frac{I}{K}\right)^2_{i,t-1} + \beta_3 \left(\frac{Sale}{K}\right)_{i,t-1} + \beta_4 \left(\frac{CF}{K}\right)_{i,t-1} * Category_{it}$$

$$+\beta_5 \left(\frac{CF}{K}\right)_{i,t-1} * (1 - Category_{it}) + \beta_6 \left(\frac{CF}{K}\right)_{i,t-1} * Category_{it} * D_P$$

$$+\beta_7 \left(\frac{CF}{K}\right)_{i,t-1} * (1 - Category_{it}) * D_P + D_P + T_t + d_j + f_i + T_t * d_j + u_{i,t}. \quad (2.13)$$

In model (2.13), we define $Category_{it}$ as a dummy variable PA_{it} equal to one if firm i is affiliated with government at year t[30]. Similarly, the firm-year observations without political affiliations are defined as $(1 - PA_{it})$. In our case, PA_{it} is time variant, since some politically affiliated firms became unaffiliated during our sample period.[31] This is mainly because that the decentralization is continuously weakening the dependence of Chinese economy on its political sector.

[29] Actually, the Chinese firms are affiliated with different levels of government, e.g. central, regional, prefecture and town levels. More specifically, government control of firms through *Lishu* affects the naming of firms, regulating their structures, reviewing their feasibility studies and business plans, approving their licenses, determining the amount of taxes and fees they should pay, approving major projects, issuing bank loans, and monitoring bank transactions (Li, 2004).

[30] We have classified firms with political affiliations into high and medium levels. Nevertheless, neither the ICFS nor the reduction effects from financing constraints are different between these two groups. Therefore, to keep our regression model as simple as possible, we merely classify firms into the groups with and without political affiliations.

[31] If we use Lishu as the main classification criterion and do the sample separation test, then a large number of firm-year observations will be dropped. Details are provided in Appendix A.

There are several other reasons for us to treat political affiliation as the complementary classification criterion to that of ownership. Firstly, in our dataset, many private firms actually were previously state-owned but were privatized during the economic reform and finally controlled by private investors. Therefore, it is very difficult for us to say that this sort of private firm does not benefit from the inherited political relationship built when they were still directly controlled by governments. Political affiliation can help us to mitigate this potential issue as almost all privatized state firms still keep the affiliated relationship with governments to some extent. Furthermore, we can also take advantage of the feature of political affiliation to directly test whether or not the increasing efficiency of resource allocation can reduce the 'political discrimination' on those private firms without government connections. Li et al. (2008) find that political relationship can help private firms in China to get access to bank loans. Nevertheless, Wu et al. (2010) emphasize that, unlike state-owned firms, private enterprises with government connections are usually less likely to suffer from policy burdens, as it is difficult for government to intervene in their operations directly. Correspondingly, governments will not support those connected private firms as strongly as they do state-owned firms, since they cannot obtain enough benefits from being supportive if they are not allowed to intervene in the operation of these connected private firms. Therefore, although the private firms with government connection can enjoy flexible budget constraints to some extent, they are still financially constrained but at lower degree than the private firms without such connection. Intuitively, if the private firms with and without connections are both financially constrained and are sensitive to the changes of outside economic and financial conditions, then both of them should be able to benefit from institutional and financial developments.

Hypothesis II: *Assuming institutional and financial development can reduce financing constraints for both private firms with and without political affiliations, we expect that both coefficients β_6 and β_7 in model (2.13) are negative and statistically significant.*

In terms of marginal effects, however, the private firms without connection should benefit more from reginal development than the privates firm with connection. Specifically, if the level of marketization can effectively measure the degree of government intervention in local business sectors, then the advantages of political connection should be lower in the regions with higher level of marketization. Meanwhile, a private firm without connection should have better financing condition if it is located in a region with a better level of development. In other words, for connected private firms, their external financing

situations are affected by developments from two opposite directions, i.e. reduction of government support and improvement of the financing environment. For non-connected private firms, however, the effects should stay on the positive side brought by regional development in institution and finance.

Hypothesis III: *If the private firms without political affiliations can benefit more from institutional and financial development than the private firms with political affiliations, then* $(\frac{|\beta_7|}{\beta_5})$ *should be larger than* $\left(\frac{|\beta_6|}{\beta_4}\right)$.[32]

Lastly, in our dataset, almost all state and collective firms have political affiliations, so it is not meaningful for us to compare the behaviours of state or collective firms with and without political affiliations. In contrast, the main body of our dataset is constituted by private firms who are much more market-oriented than state and collective firms. Considering the corresponding sample size, only half of them have political affiliations. Therefore, the estimated differences between the financing behaviours of the private firms with and without political affiliations should not only be statistically more significant but also economically interpretable.

In Appendix A, we list the definition of variables and plot the relationship between averaged province-level investment rates and the marketization index for four different ownership types. Obviously, private, foreign and collective firms located in the provinces with better institutions and financial environment tend to present higher investment rates. However, the investment behaviours of state-owned firms may not be sensitive to the outside market conditions. Similar phenomenon can also be detected in the cross-province correlations of the province averages of other firm-level variables reported in Table 2.2.

[32] Using the framework (2.13) as example, the magnitude of the coefficients for the interaction term should be related with the magnitude of the coefficient for each individual term in the regression model. In our case, the absolute value of coefficient on the interaction term of cash flow variable with development index should also be larger if the coefficient of cash flow variable itself is larger. If two groups of firms are all financially constrained but with different degrees, then the coefficients on cash flow variable for these two types of firms should also be different. In this situation, we cannot simply compare the absolute values of the coefficients on two interaction terms and conclude that one group of firms benefit more or less from regional developments. Instead, we compare the relative importance of the reduction effects brought by reforms on financing constraints for firms facing different levels of financial obstacles. Using model (2.13) as example, we can construct the following hypothesis:

$$Nonlinear\ Test:\ \ \frac{|\beta_6|}{\beta_4} = \frac{|\beta_7|}{\beta_5}$$

which is the equality between two ratios of the coefficients for the interaction terms to the coefficients for cash flow variable. If we can reject this null hypothesis, then we can conclude that one group of firms benefit more from regional institutions and financial development than the other.

Table 2.2: Cross-province correlations of firm level variables (Province Means)

State Firms				Private Firms			
	D	IK	CFK		D	IK	CFK
IK	0.072			IK	0.65***		
CFK	0.76***	0.39**		CFK	0.67***	0.43***	
SRK	0.88***	0.04	0.81*	SRK	0.85***	0.51***	0.82***

Collective Firms				Foreign Firms			
	D	IK	CFK		D	IK	CFK
IK	0.31			IK	0.62***		
CFK	0.59***	0.45**		CFK	0.43**	0.20	
SRK	0.77***	0.07	0.70***	SRK	0.76***	0.54***	0.57***

Correlations of province-level means of the firm level variables and province's institutional and financial development (Marketization index). * p<0.05, ** p<0.01, *** p<0.001

2.4.4 Firm size effects

Kumar et al. (1999) argue that the estimated financial development effect could be attributed to differences in firm size rather than financial development, since regions with a higher level of financial development may also have more large firms who are less likely to be financially constrained and may display a lower level of investment cash flow sensitivity. Therefore, we also use the firm-level variable size, defined as the logarithm of the firms' total assets, to re-classify firms. Following Guariglia (2008), we consider a firm's size relative to the situation of other firms in the industry in which that firm operates in each year. In other words, we allow firms to shift among different size categories. If the firms have the sizes in year *t* in the highest 25 percentile of the distribution of the sizes of all the firms in that particular industry and year, then these firms are defined as large firm-years ($Category_{it} = Large_{it} = 1$).[33] Similarly, we define medium-sized firm-years ($1 - Large_{it} = 1$) within an industry as those firms of a size in year *t* falling below the 75 percentile of the distribution. The main reason for us not to define small firms is that the NBS dataset only records firms with total assets above 5 million RMB (approximately 8 hundred thousand dollars). The real small and micro firms in the economy are discarded by this dataset. Therefore, merely grouping the firms in our dataset into large and medium sized categories can help us provide more representative policy implications according to the estimation results. If the estimated institutional and financial development effect is not driven from size effect, then both coefficients β_6 and β_7 in equation (2.13) should be negative and statistically significant.

[33] We have tried the 30 percentile as well. The results are largely unchanged.

2.4.5 Differential effects from institutions and financial development

In all the above analyses and hypotheses, we simply group institutions and financial development together and use the marketization index to proxy with their overall effects. Naturally, it is interesting for us to see whether institutions or financial development are more important in determining the efficiency of resource allocation in China's capital market. As mentioned in section 4.2 of this chapter, the marketization index is constructed by using five different indicators. For instance, the factor market sub-index closely measures the development of the financial market. The legal framework and commodity market sub-indexes are associated with legal and business environments. We can replace D_P term in regression (2.12) with all these province-level sub-indices and test the corresponding effects on firm-level financing constraints. Although relatively extensive discussions about the differential effects of developments in institutions and finance on efficiency of resource allocation have been provided in sections 2.2 and 2.3 in this chapter, it is still difficult for us to make plausible hypotheses about which is more important in the Chinese economy. Previous Chinese studies also have not clearly answered this question. Therefore, we prefer to draw our conclusion after obtaining the empirical results.

2.4.6 Estimation Methodology

Equation (11) is the dynamic panel data model with lagged dependent variable at the right hand side of the regression. These features create two main issues, heterogeneity and endogeneity, leading to biased OLS estimation results. In this chapter, we prefer to use the first-differenced GMM estimator developed by Arellano and Bond (1991). [34] This technique can solve the heterogeneity problem. More specifically, there are three possible sources for the presence of heterogeneity in our case. First, we assume that each firm has its own time invariant individual effect. Second, the possible province-level fixed effects may determine the coefficient of the interaction term of cash flow variable with marketization index. Lastly, firms located in different provinces may have different abilities to capture the benefits from development in institutions and finance. All these

[34] There are two reasons for us not to use system GMM (Blundell and Bond, 1998). First, Dang et al. (2015) found that system GMM could be more useful only when regressions do not have unobserved heterogeneity, endogeneity, and autocorrelation. In corporate finance, however, these conditions are rather restrictive and unlikely to be met. Second, our dataset contains almost 100,000 firms. The Monte Carlo evidence of Blundell et al. (2000) show that, when using system GMM on a large panel data to estimate a production function, the Sargan test tends to over-reject the null hypothesis of instrument validity.

factors are difficult to measure accurately and are even difficult to interpret reasonably. Therefore, we believe that first-differencing the model (2.12) can help us bypass all these issues. Besides, some other sources for the existence of the endogeneity problem, such as simultaneity and measurement errors, can be controlled by using the model variables lagged two or more periods as instruments.

The Hansen test (*J-test*) and the test for the second-order serial correlation of the residuals in the first differenced equation (AR(2)) are used to evaluate the specification of our model. If the model is correctly specified, the instruments used to identify parameters should be uncorrelated with the error term in equation (2.12). This is the null hypothesis behind the J test. The J statistic is asymptotically distributed as a chi-square with degrees of freedom equal to the number of instruments less the number of parameters. The m2 test is asymptotically distributed as a standard normal under the null of no second-order serial correlation of the differenced residuals, and further checks the specification of the model as well as the validity of the twice lagged instruments.[35]

2.5 Results

2.5.1 Baseline model

Table 2.3 contains the results from regression model (2.11) based on the Euler equation approach (2.10). We have provided OLS, fixed effects and first-differenced GMM estimators. The theoretical model predicts that the coefficient for the lagged dependent variable is positive and close to one. This reflects the persistence of adjustment cost. However, in our case, for all three estimators, this coefficient is always negative and statistically significant. The main reason is that around 40% of the firm-year observations in our dataset disinvest. We treat this as one of the important features of the Chinese unlisted firms during the sample period, so we are unwilling to delete these observations with negative investment rates (Ding and Guariglia, 2010).[36] Suffering from endogeneity as well as unobservable heterogeneity issues, the OLS estimator of the coefficient for the

[35] The only cost for using first differenced GMM in our case is that the level term of D_P will be eliminated since we follow Love (2003) and use the time invariant cross-province index. However, we are not interested in the coefficient for D_P itself, so this cost should be negligible. Details are provided in section 5.2.

[36] If we only use the firms with positive investment rates, the coefficients for the lagged IK are positive and statistically significant. However, the number of firms shrank dramatically after eliminating the firm-year observations with negative investment rates.

lagged dependent variable is likely to be upward biased while the fixed effects estimator of this coefficient tends to be lower biased. After solving these two problems, the coefficient for the lagged dependent variable generated by the first-differenced GMM estimator lies between the results from OLS and fixed effects, indicating that our preferred first-differenced GMM estimator is valid (Bond et al., 2001).

Table 2.3: Baseline specification

	OLS **(1)**	**Fixed effects** **(2)**	**FD GMM** **(3)**
IK_{it-1}	-0.072***	-0.260***	-0.092***
	(0.002)	(0.002)	(0.032)
IK_{it-1}^2	-0.004***	0.013***	-0.020
	(0.001)	(0.002)	(0.013)
SRK_{it-1}	0.012***	0.037***	0.040***
	(0.000)	(0.000)	(0.003)
CFK_{it-1}	0.101***	0.057***	0.123***
	(0.002)	(0.003)	(0.023)
R-Square	0.056	-	-
Rho		0.415***	-
AR(2)	-	-	0.609
J-test	-	-	0.199
Observation	348861	348861	348861
Firms	-	94673	94673

This table reports the results for equation (2.12). FD-GMM means first-differenced GMM estimators. In column (3), all regression variables lagged twice and more are used as instruments. P-values of both AR(2) and Hansen tests are provided. Rho is fraction of variance due to the presence of fixed effects. Time dummies and time dummies interacted with industry dummies are included in all specifications. To make the results more comparable, we use the same sample periods to run FD-GMM, OLS and FE estimators, since GMM estimator will discard two years data as instruments. Standard errors are provided in parentheses, * P<0.10 ** P<0.05 *** P<0.01.

Besides this, the theory predicts that the coefficient for the square of lagged investment rate should be negative and statistically significant. However, this is the only case for the OLS estimator. Although this coefficient is indeed negative for the first-differenced GMM estimator, it is statistically insignificant. This is probably caused by the fact that we have grouped firms with all types of ownership to estimate the regression model. In our latter sample separation tests, this coefficient not only remains negative but also becomes statistically significant in most of the specifications. Furthermore, the positive and statistically significant coefficients for the sales term reflect the existence of imperfect competition in the Chinese product market. As we expected, the cash flow coefficients are positive and statistically significant for all three types of estimators. Referring to the results from the first-differenced GMM, the cash flow coefficient is 0.12 and the corresponding elasticity evaluated at sample medium values is 0.40. This indicates that financial

constraint is present in the Chinese capital market. Lastly, the p-value of over-identification and AR(2) tests is 0.61 and 0.20, respectively. This means that our instruments are valid and there is no second order serial correlation in the error term.

2.5.2 Sample separation tests by ownerships

Table 2.4 represents the estimated results of regression model (2.12) for firms with different ownership types. In this specification, we have added an interaction term of cash flow with the standardized marketization index in the regression model, so the coefficient on cash flow variable itself should be interpreted as a measure of the dependence of investment on cash flow for the firms located in the provinces with average level of institutions and financial development, i.e. $D_P = 0$. According to the results for private and foreign firms presented in columns (2) and (3) of table 2.4, the two coefficients on the interaction terms are both negative. However, the only statistically significant coefficient is for private firms. The specific interpretation is that the private firms in the provinces with average level of institutions and financial development, such as Anhui, Chongqing or Shandong (assume $D_P = 0$), present an ICFS around 0.28 (0.28-0.15*0). For foreign and collective firms located in the same regions, the ICFS is 0.21 and 0.06, respectively. Additionally, the private firms in the provinces with lower level of institutions and financial development, such as Shanxi, Yunnan and Neimenggu (assume $D_P = -1$ or one standard deviation below the mean), have an ICFS equal to 43% (0.28-0.15*(-1)). In contrast, for the private firms in the provinces with higher level of institutions and financial development, such as Shanghai, Guangdong, Zhejiang, the combined coefficient on the cash flow is very small, e.g. 0.28-0.15*1.7 = 0.03 and may be also statistically insignificant.

For state firms, however, the coefficient on cash flow variable is small in magnitude and statistically insignificant. This indicates that the firms uncontrolled by governments, e.g. private and foreign firms, are more financially constrained than those controlled by governments, e.g. state and collective firms. In columns (1) and (4) of table 2.4, the coefficients for the interaction terms are likely to be positive but statistically insignificant for state and collective firms. This indicates that regional development in institutions and finance may increase the financing constraints for state and collective firms. Nevertheless, such a budget binding effect is unlikely to be important. Furthermore, in all columns, neither the over-identification test nor the m2 test for second-order autocorrelation of the differenced residuals is rejected, indicating correct specifications of the models and

validity of the chosen instruments. Overall, these results are partly consistent with our **hypothesis I** that institutional and financial development can reduce financing constraints for Chinese firms but this reduction effect is more significant for private firms.

Table 2.4: Interaction of cash flow with marketization index analysis[37]

	State (1)	**Private** (2)	**Foreign** (3)	**Collective** (4)
IK_{it-1}	-0.108***	-0.083***	-0.135**	-0.134***
	(0.011)	(0.004)	(0.061)	(0.011)
IK_{it-1}^2	-0.023**	-0.014***	-0.040*	-0.036***
	(0.011)	(0.003)	(0.022)	(0.009)
SRK_{it-1}	0.031***	0.039***	0.025***	0.028***
	(0.008)	(0.003)	(0.008)	(0.003)
CFK_{it-1}	**0.026**	**0.286*** **	**0.211***	**0.057****
	(0.026)	(0.083)	(0.112)	(0.029)
$CFK_{it-1} * D_p$	0.020	**-0.155*** **	-0.107	0.009
	(0.030)	(0.056)	(0.080)	(0.029)
AR(2)	0.674	0.201	0.849	0.953
J-test	0.426	0.174	0.470	0.739
Observation	33787	204532	64383	30501
Firms	8915	57641	15929	8365

This table reports the results for equation (2.12). All regression variables lagged twice and more are used as instruments. Time dummies, and time dummies interacted with industry dummies, are included in all specifications. P-values of both AR(2) and Hansen tests are provided. D_p is the province-level average value of marketization index. Standard errors are reported in parentheses, * p<0.10, ** p<0.05, *** p<0.01. $IK_{it-1} = \text{Investment}_{it-1}/\text{Capital Stock}_{it-1}$; $SRK_{it-1} = \text{Sales}_{it-1}/\text{Capital Stock}_{it-1}$; $CFK_{it-1} = \text{Cash flow}_{it-1}/\text{Capital Stock}_{it-1}$

In terms of financing constraints analysis, our results are comparable with those of Hericourt and Ponect (2009), Poncet et al. (2010) and Ding et al. (2013) who find that state and collective firms are the least financially constrained as they can enjoy subsidies from governments and easier credit from banks, while private firms are often discriminated against by the official financing channels and appear to be most financially constrained. Besides, Guariglia et al. (2011) analyze the relationship between firm growth and internal funds and find that real activities of foreign firms should be affected by the availability of cash flow. Chen and Guariglia (2013) detect a high correlation between total productivity and cash flow for foreign firms as well. They emphasize that foreign firms operating in China often enjoy a more favorable environment, such as lower tax rates, but they still share many features with domestic private firms. The World Bank (2005) documents that

[37] We have tried different combinations of instrument sets. For instance, to control the heterogeneous behaviours of firms caused by regional differences, Love (2003) used the lagged interactions of index with all regression variables as instruments. We have also created a dummy variable to classify firms into high and low development provinces and interacted this dummy with each variable to use as instruments. Nevertheless, none of them changes the results significantly. Therefore, we only use the lagged variables presented at the right hand side of the regression as instruments. This should make our instrument sets more parsimonious.

fully foreign owned firms operating in China have, in fact, limited access to domestic direct finance.

Lastly, there is another way for us to obtain a similar conclusion that institutional and financial development can lower financing constraints. At the cross-province level, our dataset is very unbalanced with almost 45% firms located in the coastal area, especially in Jiangsu, Guangdong and Zhejiang. Therefore, the results obtained from regression (2.12) may be affected by this problem since provinces with more number of firms may impose higher weight on the coefficient for the interaction term. To further justify our main results, we have separately estimated regression (2.11) for the firms located in the provinces with a value of standardized marketization index above and below zero. Results are presented in Table 2.5. From columns (1) to (4), we can clearly see that the ICFS for state and collective firms located in provinces with low development is small and statistically insignificant, while it is positive and statistically significant for those firms located in relatively developed provinces. This confirms the rest of our **hypothesis I** that institutional and financial development can increase the financing constraints for government controlled firms. From columns (5) to (8), private and foreign firms in low development regions indeed present much a higher level of ICFS than firms in regions with better institutions and financial markets. In summary, these findings indicate that our main results from regression (2.12) do not seriously suffer from the uneven distribution of firms at province-level and further approve the reasonability of our main hypothesis.

2.5.3 Political affiliation

Table 2.6 contains the results for the effects of political affiliations of private firms. In column (1), we firstly report the simplified version of regression model (2.13) without a marketization index interaction term. Private firms with and without political affiliations present ICFS at 0.10 and 0.21, respectively. According to the F-test results, the null hypothesis, that the firms with and without political affiliations present the same level of ICFS, can be rejected at 1% significant level. This indicates that the private firms affiliated with governments are likely to enjoy better protection and more privileges of access to bank loans in China (Guariglia and Mateut, 2013).

Table 2.5: Region separation analysis (High and low developments)

	State		Collective		Private		Foreign	
	LD	**HD**	**LD**	**HD**	**LD**	**HD**	**LD**	**HD**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
IK_{it-1}	-0.114***	-0.096***	-0.148***	-0.118***	-0.105***	-0.076***	-0.105***	-0.150***
	(0.015)	(0.015)	(0.017)	(0.014)	(0.007)	(0.005)	(0.028)	(0.040)
IK_{it-1}^2	-0.023*	-0.019	-0.046***	-0.025**	-0.016***	-0.012***	0.002	-0.047***
	(0.014)	(0.018)	(0.015)	(0.011)	(0.005)	(0.003)	(0.017)	(0.014)
SRK_{it-1}	0.034***	0.027***	0.036***	0.024***	0.018***	0.044***	0.020**	0.028***
	(0.008)	(0.008)	(0.005)	(0.003)	(0.004)	(0.003)	(0.010)	(0.004)
CFK_{it-1}	**0.003**	**0.072****	**0.041**	**0.075*****	**0.242*****	**0.124*****	**0.197***	**0.052*****
	(0.034)	(0.030)	(0.035)	(0.024)	(0.092)	(0.036)	(0.110)	(0.009)
AR(2)	0.309	0.565	0.969	0.908	0.664	0.260	0.294	0.896
J-test	0.253	0.236	0.582	0.216	0.520	0.263	0.322	0.499
Obs.	19984	13803	11491	19010	53332	151200	4117	60266
Firms	5432	3483	3261	5104	15726	41915	1064	14865

This table reports the results for equation (2.11). HD (LD) means that firms located in the provinces with the value of standardized marketization index larger (smaller) than zero. All regression variables lagged twice and more are used as instruments. Time dummies, and time dummies interacted with industry dummies, are included in all specifications $IK_{it-1} = \text{Investment}_{it-1}/\text{Capital Stock}_{it-1}$; $SRK_{it-1} = \text{Sales}_{it-1}/\text{Capital Stock}_{it-1}$; $CFK_{it-1} = \text{Cash flow}_{it-1}/\text{Capital Stock}_{it-1}$. P-values of both AR(2) and Hansen tests are provided. Standard errors are reported in parentheses,*p<0.10,**p<0.05,***p<0.0

Nevertheless, we are unwilling to conclude that private firms can mitigate negative effects from financing constraints by proactively choosing to be affiliated with governments. Except for ownership and political affiliation, the NBS dataset also provides registration information for each firm. However, this register code may not be able to describe the government connections for firms accurately, since many firms have changed their ownership types during the process of economic reforms. In Appendix A, Table A.13 presents the political affiliation status of private firms as an example. There are two very distinct features. First, firms registered as purely private firms account for more than 70% of all the firms labelled as 'private'. Second, the private firms with political affiliations are mainly privatized state and collective firms and the firms with other kinds of liabilities. These firms may have had government connections at the beginning of construction. It is highly doubtful that political affiliation is still an active option for newly established purely private firms in China. In this chapter, therefore, we only regard political affiliation (*Lishu*) as a result caused by unaccomplished decentralization and expect that the corresponding effects on firm performance will diminish gradually with the process of marketization.

In column (2) of Table 2.6, we present the results from regression model (2.13) for private firms. The coefficients for the triple interactive term, which examine the effects of institutional and financial development on the dependence of investment on cash flow for the firms with and without political affiliations, are all negative and statistically significant (**Hypothesis II**). In the provinces with average level of development, if the standardized marketization index increases by one standard deviation above the mean zero, then the ICFS for the local private firms with political affiliations will reduce by 47% from 0.17 to 0.09. Similarly, the regional developments can reduce the ICFS for the private firms without political affiliations by almost 60% from 0.42 to 0.15. Besides, the results from the non-linear test of the null hypothesis, that the firms with and without political affiliation can benefit from regional development at the same level, can be rejected at 5% significant level. Since 60% is larger than 47% in magnitude, we conclude that private firms without political affiliations may benefit more from developments in institutions and finance. These results confirm our **hypothesis III** that market-oriented reforms should gradually reduce the political pecking order effects in China's capital market. [38] Lastly, in columns (3) and (4), we again separate private firms into low and high development regions and re-

[38] For foreign firms, similar patterns of ICFS can be also detected but the difference of the changes of cash flow related coefficients between the firms with and without political affiliations is statistically insignificant. This may be caused by the unbalanced cross-province distribution of foreign firms in China, as almost 93% of foreign firms were constructed in the provinces with a value of marketization index above zero. Therefore, in the size and sub-index estimations, we only use private firms.

estimate regression model (2.13) without a marketization index interaction term. Obviously, the ICFS (for both private firms with and without political affiliations) declines from the low to the high development regions.

Table 2.6: Political affiliation analysis

	Private Firms			
	PA	**PA*D**	**LD**	**HD**
	(1)	**(2)**	**(3)**	**(4)**
IK_{it-1}	-0.081***	-0.083***	-0.100***	-0.084***
	(0.004)	(0.004)	(0.008)	(0.004)
IK_{it-1}^2	-0.013***	-0.015***	-0.017***	-0.010***
	(0.002)	(0.003)	(0.005)	(0.003)
SRK_{it-1}	0.040***	0.039***	0.021***	0.025***
	(0.003)	(0.003)	(0.007)	(0.001)
$CFK_{it-1} * PA_{it}$	0.099***	0.172***	0.254***	0.144***
	(0.022)	(0.031)	(0.083)	(0.025)
$CFK_{it-1} * (1 - PA_{it})$	0.212***	0.424***	0.483***	0.251***
	(0.047)	(0.072)	(0.187)	(0.053)
$CFK_{it-1} * PA_{it} * D_p$		-0.082***		
		(0.021)		
$CFK_{it-1} * (1 - PA_{it}) * D_p$		-0.254***		
		(0.046)		
(None)-Linear Test	0.000***	0.021**	0.036**	0.001***
AR(2)	0.151	0.262	0.695	0.140
J-test	0.162	0.112	0.625	0.317
Observations	204532	204532	53332	151200
Firms	57641	57641	15726	41915

This table reports the results for equation (2.13). All regression variables lagged twice and more are used as instruments. Time dummies, and time dummies interacted with industry dummies, are included in all specifications. P-values of both AR(2) and Hansen tests are provided. $IK_{it-1} = \text{Investment}_{it-1}/\text{Capital Stock}_{it-1}$; $SRK_{it-1} = \text{Sales}_{it-1}/\text{Capital Stock}_{it-1}$; $CFK_{it-1} = \text{Cash flow}_{it-1}/\text{Capital Stock}_{it-1}$. HD (LD) means that firms located in provinces with the value of standardized marketization index larger (smaller) than zero. D_p is the province-level averaged marketization index. PA_{it} is the time variant dummy variable to indicate that a firm is affiliated with government in that year. In columns (1), (3) and (4), P-values are provided for linear tests to the null hypothesis: $\beta_4 = \beta_5$. In column (2), P-value is provided for non-linear test to the null hypothesis: $-\beta_6/\beta_4 = -\beta_7/\beta_5$. Standard errors are reported in parentheses, * p<0.10, ** p<0.05, *** p<0.01.

2.5.4 Size Classification

In column (1) of Table 2.7, replacing $Category_{it}$ with size dummies, we report the results for the simplified version of regression model (2.13) without marketization index interactive terms. For the firms with private ownership, large-sized firm-year observations present higher ICFS than medium-sized firm-year observations do. The null hypothesis, that size does not affect the dependence of firms' investment on cash flow variable, can be rejected at 1%, indicating that larger firms in China are actually more financially

constrained than smaller firms. Nevertheless, this result is opposite to the conventional impression that small firms should be more financially constrained than large firms (Kashyap et al., 1993). This could be the result of a crowding out effect in external financing faced by large firms without government connections when the government provides privileged access to credit to large firms that have political backgrounds (Cull et al., 2015). Larger private firms are likely to be important for economic growth. Our findings warn of severe misallocation of credit in China.

In column (2) of Table 2.7, the marketization index is interacted with size dummies and cash flow variable. The coefficient on this triple interaction term of private firms with medium size is negative and statistically significant but it is very small in magnitude and statistically insignificant for large-sized private firms. Given the result from the nonlinear test, the null hypothesis, that firms with different sizes can benefit from regional development at the same degree, can be rejected at 1% significant level. This indicates that institutional and financial development may merely reduce financing constraints for medium-sized firms but not for large-sized firms. These results are further confirmed by the results obtained from regional separation tests presented in columns (3) and (4). Previous literature on cross-country analysis usually finds that smaller firms can benefit more from development (Love, 2003 and Harrison et al., 2004).

Nevertheless, these results have not directly answered the question of whether regional development can mitigate the crowding effects in external financing caused by political discrimination against large firms, since the coefficient on the triple interactive term for large-sized firms is statistically insignificant. One possible issue is that ownership structure itself may not be able to fully capture large-sized firms' government connections. To address this issue, we firstly classify private firms into the regions with higher or lower level of development. Then, further classify firm-years according to the status of political affiliations within each size category[39].

[39] The results should be more convincing than comparing the firms with and without state ownership. The government controlled and uncontrolled firms tend to work under two different systems in China. Nevertheless, private firms themselves have choices to build relationship with governments or behaviour strictly according to market mechanisms. Loosely speaking, our tests aim at detecting whether or not the benefits from political connections are diminished with the marketization process in China. In other words, is it better for private firms to choose to build political relationship or to follow market principles?

Table 2.7: Size classification analysis

	Private Firms			
	Size	**Size*D**	**LD**	**HD**
	(1)	**(2)**	**(3)**	**(4)**
IK_{it-1}	-0.082***	-0.083***	-0.105***	-0.083***
	(0.004)	(0.004)	(0.008)	(0.004)
IK_{it-1}^2	-0.014***	-0.015***	-0.017***	-0.010***
	(0.002)	(0.003)	(0.005)	(0.003)
SRK_{it-1}	0.041***	0.040***	0.020***	0.030***
	(0.003)	(0.003)	(0.007)	(0.001)
$CFK_{it-1} * Large_{it}$	0.287***	0.283***	0.378***	0.304***
	(0.023)	(0.031)	(0.050)	(0.022)
$CFK_{it-1} * (1 - Large_{it})$	0.113***	0.239**	0.195*	0.031***
	(0.040)	(0.098)	(0.110)	(0.040)
$CFK_{it-1} * Large_{it} * D_p$		0.003		
		(0.026)		
$CFK_{it-1} * (1 - Large_{it}) * D_p$		**-0.148****		
		(0.065)		
(None)-Linear Test	0.000***	0.000***	0.050**	0.000***
AR(2)	0.189	0.211	0.618	0.172
J-test	0.411	0.288	0.747	0.010**
Observations	204532	204532	53332	151200
Firms	57641	57641	15726	41915

This table reports the results for equation (2.13). All regression variables lagged twice and more are used as instruments. Time dummies, and time dummies interacted with industry dummies, are included in all specifications. P-values of both AR(2) and Hansen tests are provided. $Large_{it}$ is a dummy variable equal to one if the log of the total assets of the firm above the 75 percentile of the log of the total assets in the corresponding industry i at the year t. Similarly, $(1 - Large_{it})$ are medium-sized firm-years lying below the 75 percentile. Firms are allowed to shift among size categories. $IK_{it-1} = \text{Investment}_{it-1}/\text{Capital Stock}_{it-1}$; $SRK_{it-1} = \text{Sales}_{it-1}/\text{Capital Stock}_{it-1}$; $CFK_{it-1} = \text{Cash flow}_{it-1}/\text{Capital Stock}_{it-1}$. D_p is the province-level averaged marketization index. $Large_{it}$ is the time variant dummy variable to indicate that a firm is classified into the group with large size in that year. In columns (1), (3) and (4), P-values are provided for linear tests to the null hypothesis: $\beta_4 = \beta_5$. In column (2), P-value is provided for non-linear test to the null hypothesis: $-\beta_6/\beta_4 = -\beta_7/\beta_5$. HD (LD) means that firms located in provinces with the value of standardized marketization index larger (smaller) than zero. Standard errors are reported in parentheses, * p<0.10, ** p<0.05, *** p<0.01.

The results are presented in Table 2.8. In the provinces with either lower or higher level of development, the large-sized firm-year observations affiliated with governments always presents lower ICFS than the large-sized firm-year observations without political affiliations. The difference between the two corresponding cash flow coefficients is statistically significant for the private firms located in the provinces with lower level of development, but becomes statistically insignificant for the private firms located in the provinces with relatively high level of development. This is mainly because the ICFS for the large-sized private firms without political affiliations has changed from 0.38 to 0.30, while the ICFS for the large-sized firms affiliated with governments almost remains the same. Therefore, although the large size of institutions and high level of financial

development may not be able to increase the financing constraints for the large private firms with political affiliations, they at least reduce the financing constraints for the large private firms without government connections. This indicates that the marketization process is creating a better business environment for the firms without political privileges. These results are partly consistent with the implication of our **hypothesis III** and suggest that institutional and financial development may eliminate the crowding out effects, mainly generated by political pecking order effects, in China's capital market.[40]

Table 2.8: Size and political affiliation analysis

	Private Firms	
	LD	**HD**
	(1)	**(2)**
IK_{it-1}	-0.103***	-0.084***
	(0.007)	(0.004)
IK_{it-1}^2	-0.016***	-0.012***
	(0.005)	(0.003)
SRK_{it-1}	0.026***	0.030***
	(0.002)	(0.001)
$CFK_{it-1} * Large_{it} * PA_{it}$	0.289***	0.286***
	(0.043)	(0.027)
$CFK_{it-1} * Large_{it} * (1 - PA_{it})$	0.385***	0.309***
	(0.039)	(0.024)
$CFK_{it-1} * (1 - Large_{it}) * PA_{it}$	0.054***	0.023**
	(0.017)	(0.012)
$CFK_{it-1} * (1 - Large_{it}) * (1 - PA_{it})$	0.067***	0.036***
	(0.020)	(0.010)
H0: $\beta_4 = \beta_5$	**0.031****	**0.43**
H0: $\beta_6 = \beta_7$	0.504	0.33
AR(2)	0.601	0.121
J-test	0.200	0.091*
Observations	53332	151200
Firms	15726	41915

This table reports the results for equation (2.13) without the $D_p$term. HD (LD) means that firms located in provinces with the value of normalized marketization index larger (smaller) than zero. All regression variables lagged twice and more are used as instruments. Time dummies, and time dummies interacted with industry dummies, are included in all specifications. P-values of both AR(2) and Hansen tests are provided. $Large_{it}$ is a dummy variable equal to one if the log of the total assets of the firm above the 75 percentile of the log of the total assets in the corresponding industry i at the year t. Similarly, $(1 - Large_{it})$ are medium-sized firm-years lie below the 75 percentile. Firms are allowed to shift among size categories. $PA_{it}$is the time variant dummy variable to indicate that a firm is affiliated with government in that year. $IK_{it-1} = \text{Investment}_{it-1}/\text{Capital Stock}_{it-1}$; $SRK_{it-1} = \text{Sales}_{it-1}/\text{Capital Stock}_{it-1}$;$CFK_{it-1} = \text{Cash flow}_{it-1}/\text{Capital Stock}_{it-1}$. In columns (1) and (2), P-values are provided for linear tests. Standard errors are reported in parentheses, * p<0.10, ** p<0.05, *** p<0.01

[40] We do not further report the details about foreign firms, since the corresponding results do not change very significantly.

2.5.5 Sub-categories of marketization index

The marketization index is constructed by using five different sub-categories covering both institutional development and financial development. As the above results indicate that private firms may benefit most from developments, we use private firms as the target sample to re-estimate the regression model (2.12) for each sub-index. The results are presented in Table 2.9. In column (1), we use cash flow variable interacted with the sub-index for financial market development. The corresponding coefficient for the interaction term is -0.054, which is statistically significant, indicating that one standard deviation of the level of financial market development above the mean zero can reduce the ICFS by 15%. In columns (2) and (3), the sub-indexes of non-state enterprises sector growth and government-market relations are more related with developments in political institutions. The corresponding coefficients on the interactive terms are all negative and statistically significant, indicating that expansion of private sectors and reduction in government intervention can reduce the ICFS for private firms by 45% and 72%, respectively (at index = 1). In columns (4) and (5), the legal framework and commodity market developments are associated with the business protection. The former measures the status of legal protection to both the investors and consumers, while the latter mainly concentrates on the conditions of cross-province trade barriers caused by government protection of the local/ provincial economy. Legal development can only reduce the ICFS for private firms by 14% but the reduction of trade barriers can reduce by 71%.

Furthermore, we incorporate the interaction terms of all sub-indexes with cash flow variable into the regression model and see which ones still retain their significances. The results are presented in column (6) of Table 2.9. Except for the coefficient on the government market relationship, all other statistically significant coefficients maintain the same signs as well as similar values in magnitudes with those of coefficients in columns (1) to (5). The insignificance of government market relationship coefficient is probably because its explanatory power has been absorbed by the sub-index measuring the development of the local non-state economy which mainly also reflects the diminishing of state capital in a region. From Table A.13 in Appendix A, we can see that provinces are ranked in almost the same order within these two sub-indexes.

Table 2.9: Sub-categories of marketization index

	Financial markets (1)	Non-state sector (2)	Government market (3)	Legal framework (4)	Commodity market (5)	All Components (6)
IK_{it-1}	-0.083***	-0.083***	-0.082***	-0.085***	-0.083***	-0.085***
	(0.004)	(0.004)	(0.004)	(0.004)	(.004)	(0.004)
IK_{it-1}^2	-0.013***	-0.014***	-0.014***	-0.013***	-0.014***	-0.013***
	(0.002)	(0.003)	(0.002)	(0.002)	(.003)	(0.002)
SRK_{it-1}	0.039***	0.040***	0.039***	0.037***	0.040***	0.037***
	(0.003)	(0.003)	(0.003)	(0.003)	(.003)	(0.003)
CFK_{it-1}	0.377***	0.277***	0.273***	0.289***	0.256***	0.379***
	(0.126)	(0.083)	(0.083)	(0.081)	(0.074)	(0.085)
$CFK_{it-1} * Financial_p$	-0.054***					-0.046***
	(0.021)					(0.013)
$CFK_{it-1} * Nonstate_p$		-0.151***				-0.170***
		(0.057)				(0.046)
$CFK_{it-1} * GovMarket_p$			-0.198***			-0.015
			(0.076)			(0.034)
$CFK_{it-1} * Legal_p$				-0.041***		-0.024***
				(0.013)		(0.006)
$CFK_{it-1} * Commodity_p$					-0.182***	-0.102***
					(0.066)	(0.034)
AR(2)	0.227	0.196	0.181	0.207	0.186	0.217
J-test	0.099*	0.167	0.141	0.174	0.156	0.089*
Observation	204532	204532	204532	204532	204532	204532
Firms	57641	57641	57641	57641	57641	57641

All regression variables lagged twice and more are used as instruments. Time dummies and time dummies interacted with industry dummies are includ all specifications. P-values of both AR(2) and Hansen tests are provided. IK_{it-1} = Investment$_{it-1}$/Capital Stock$_{it-1}$; SRK_{it-1} = Sales Capital Stock$_{it-1}$;CFK_{it-1} = Cash flow$_{it-1}$/Capital Stock$_{it-1}$. $Factor_p$ is the measure to the developments of financial markets. $GovMarket_p$ indi the government market relationship. $Legal_p$ measures the legal environment for businesses. $Commodity_p$ indicates the market pricing and degree of trade protection. Standard errors are reported in parentheses, * p<0.10, ** p<0.05, *** p<0.01.

Overall, these results indicate that both market related developments (e.g. financial and legal sectors) and government related developments (e.g. reduction of intervention and diminishing of regional protection) should be able to reduce financing constraints for private firms by increasing the efficiency of resource allocation in China's capital market. Nevertheless, the latter plays a much more important role than the former, indicating that the political pecking order effect is one of the main causes of credit misallocation in China. In addition, the functions of development of factor markets and the improvement of legal protection to private businesses are important but limited. Without the widening separation between government and business sectors, the benefits from financial reforms and liberalizations may be difficult for firms and agencies in the economy to fully capture.

2.6 Robustness Check

2.6.1 Sampling issue

Since the sample used to do estimation is very unbalanced, the key results of the changing pattern of ICFS may be sample driven. Therefore, we re-estimate the regression model (2.11) for the firms located in each province or region. Although some coefficients are statistically insignificant due to small sample issue, both signs and magnitudes of those coefficients are very consistent with predictions. We collect all the cash flow coefficients and plot them along the province-level marketization index. According to Figure 2.1, there should be a negative relationship between development and the degree of financing constraint in China. It seems that this relationship has a nonlinear feature, which may be caused by the geographical segmentation. If we exclude those provinces presented at the right top angle of the Figure, then we shall be able to see a much more obvious linear pattern. Generally, the estimated causal relationship that institutional and financial development can reduce financing constraints for firms should be an intrinsic fact rather than a sample driven false impression.

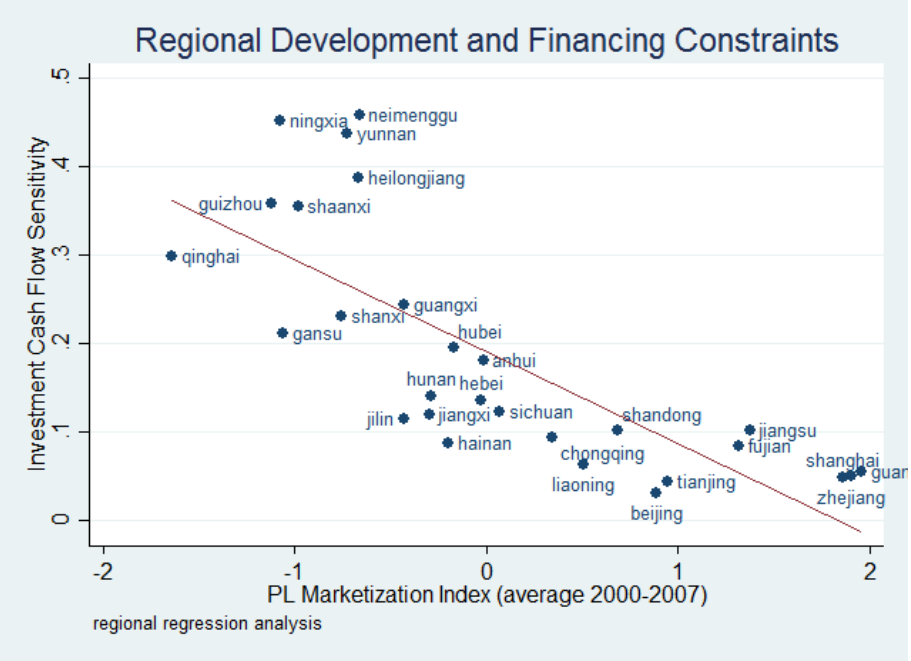

Figure 2.1: Investment cash flow sensitivity for private firms

2.6.2 Industry clarification

In China, firms distribute unevenly in different industries both across and within regions. Although we have included the interaction of industry dummies and time dummies into the regression model, there is still the possibility that our main results suffer from this uneven distribution issue, e.g. some industries heavily depend on external finance while others do not. Therefore, we classify the provinces and regions into seven groups according to different levels of development index. The first column of Table A.12 in Appendix A presents the average level of marketization index for each group. There is an obvious declining tendency. For each group, we have calculated the averaged proportions of all nine industries (in each row). We can detect that regions with higher level of development have more firms involved in the electrical and textile industries while less firms are involved in the mining industry. For other industries, the declining or increasing pattern is not obvious. Therefore, we exclude these three industries from the dataset and re-estimate the regression model (2.11) for private firms only. The results are reported in column (1) of Table 2.10. The coefficient on the interaction between cash flow and development index is still negative and statistically significant. This further proves that this sort of uneven distribution of industries should not affect our main inferences.

Table 2.10: Industry and model selection issues (private firms)

	Industry Control (1)		Time variant (2)		Accelerator model (3)
IK_{it-1}	-0.089***		-0.083***		-
	(0.005)		(0.007)		
IK_{it-1}^2	-0.015***		-0.002		-
	(0.003)		(0.005)		
SRK_{it-1}	0.037***		0.032***	$\Delta S_{it}/K_{it-1}$	0.010*
	(0.004)		(0.004)		(0.005)
CFK_{it-1}	0.315***		0.147***	CF_{it}/K_{it-1}	0.302***
	(0.090)		(0.049)		(0.050)
CFK_{it-1}	-0.127**	CFK_{it-1}	-0.067*	(CF_{it}/K_{it-1})	-0.056**
$* D_p$	(0.049)	$* D_{pt}$	(0.038)	$* D_p$	(0.024)
		D_{pt}	-0.087**		
			(0.044)		
AR(2)	0.198		0.380		0.404
J-test	0.202		0.335		0.000***
Obs.	136215		58044		195538
Firms	38759		9675		44072

In column (1), firms in electrical, textile and mining sectors are excluded from the sample. In all columns, regression variables lagged twice and more are used as instruments. In column (2), D_{pt} is the time variant marketization index. ΔS_{it} is the change of real sales. Time dummies and time dummies interacted with industry dummies are included in all specifications. P-values of both AR(2) and Hansen tests are provided.

2.6.3 Time variant index

China is a big country with many provinces and regions. Our main results have only considered the cross-province variations of institutions and financial development. It is reasonable for us to ask whether or not the improvement of the business environment within a province can continuously increase the efficiency of resource allocation in the local capital market. Nevertheless, our original dataset contains very frequent entry and exit. If there are many newly constructed firms in a given year, then the reduction effects from regional development on the overall status of financing constraint in that year may be cancelled out by the fact that young and newly established firms are usually very financially constrained. This is similar for the outcome of a large number of exits. Besides, after applying a first-differenced GMM estimator, the time effects will be further diminished, as the estimated sample periods will be further reduced due to the use of lagged variables as instruments.

Therefore, to bypass all these potential issues and to use the time variant marketization index, we have excluded all the firms without consecutive observations during the whole sample period from 2000-2007. The results for private firms are presented in column (2) of Table 2.10. The coefficients on the cash flow variable and the interaction term are 0.15 and -0.07, respectively, indicating that one standard deviation above the sample average of marketization index across province-years implies a 47% decline in ICFS. The p-values of both Hansen and AR(2) test are larger than 10%. Therefore, our model should be correctly specified and the chosen instruments should be valid. Although the estimated sample size becomes relatively small, this result still has very strong policy implications. For instance, it is usually difficult for firms to change their locations from an undeveloped province to the developed province. Our results indicate that if the local authority can consistently increase the business environment in the province, then the local firms will also be able to benefit from the development.

2.6.4 Model selection

The theoretical prediction from the Euler equation to the coefficients for the lagged investment rate should be positive. However, in our case, it is negative. Possible reasons and statistical justifications have already been provided in section 5.1 of this chapter. The main reason for us to insist on using the linearized Euler equation model is that the presence of cash flow term is associated with a theoretical justification of financing constraints. In the robustness check, we change the baseline specification into the modified accelerator model and add the cash flow variable intuitively into the right hand side of the regression. The results for private firms are presented in column (3) of Table 2.10. As we expected, the interaction term of cash flow with marketization index is negative and statistically significantly. Although the Hansen test is rejected, the AR(2) test is passed. Therefore, our main results should not suffer from the model selection issue. This is also consistent with the statement from D'Espallier and Guariglia (2013) who argue that the investment opportunities bias does not affect the ICFS for unlisted firms.

Table 2.11: Cash flow separation analysis

	Private Firms		Foreign Firms	
	High cash flow (1)	**Low cash flow (2)**	**High cash flow (3)**	**Low cash flow (4)**
IK_{it-1}	-0.095***	-0.076***	-0.117***	-0.151**
	(0.005)	(0.005)	(0.044)	(0.070)
IK_{it-1}^2	-0.024 ***	-0.007*	-0.038**	-0.034
	(0.003)	(0.004)	(0.015)	(0.025)
SRK_{it-1}	0.036***	0.046***	0.024***	0.021**
	(0.003)	(0.005)	(0.005)	(0.008)
CFK_{it-1}	0.191**	0.473***	0.138*	0.493**
	(0.082)	(0.133)	(0.075)	(0.248)
$CFK_{it-1} * D_p$	-0.083*	-0.176***	-0.042	-0.247*
	(0.046)	(0.062)	(0.043)	(0.138)
AR(2)	0.139	0.839	0.528	0.919
J-test	0.741	0.320	0.792	0.882
Obs.	108696	95836	38001	26382
Firms	29952	27689	9141	6788

High (Low) cash flow: dummy variable equals if the average value of a firm's cash flow above (below) sample medium. Regression variables lagged twice and more are used as instruments. D_p is the province-level averaged marketization index. Time dummies and time dummies interacted with industry dummies are included in all specifications. P-values of both AR(2) and Hansen tests are provided.

2.6.5 Internal financial constraints

According to the first column of Table 2.1, we can see that the province-level mean values of cash flow differ dramatically among provinces from 0.11 in Gansu to 0.35 in Henan. According to previous literature, such as KZ (1997), Cleary et al. (2007) and Guariglia (2008), the investment cash flow relationship may be nonlinear. In other words, the institutional and financial development effects detected in our results may simply be driven by the possible situation that firms within different provinces have different degrees of internal financial constraints. For instance, in our dataset, firms located in the provinces with higher level of institution and financial development also have higher value of cash flow, indicating that their lower investment cash flow sensitivity may simply be driven by the fact that they already have a large amount of internal funds and their real activities are not sensitive to the variations of cash flow. To see whether this is the case or not, we define the firms as internal (non-) financially constrained firms if they have average value of cash flow below (above) the sample average value of cash flow. Simply speaking, we have created two cross-province subsamples, one contains the firms with high level of cash flow and the other contains the firms with low level of cash flow. We re-estimate equation (11) for each subsample separately for private and foreign firms. Results are reported in Table

2.11. As we expected, investment of firms with low level of cash flow is much more sensitive to the variation of cash flow than that of firms with high level of cash flow. Meanwhile, three out of four coefficients on the interaction between cash flow and marketization index are negative and statistically significant. This indicates that the effects of institutional and financial development on financing constraints are not fully driven by the average financial status of firms in different provinces.

2.6.6 Alternative arguments

Our major hypothesis is that institutional and financial development can mitigate financing obstacles for private firms and hence reduce the sensitivity of their investments to cash flow variations. At the first glance, our results indeed support such inference. Nevertheless, it is still undeniable that there are several alternative arguments which can provide opposite predictions to the effects of regional development on the firm-level investment cash flow sensitivity. For instance, with more market-based environment, private firms shall be more confident on market and institutions, and therefore, they shall be more willing to invest their profits or cashes earned from business into the tangible assets with more irreversibility. This sort of 'encourage' argument suggests a positive effect, rather than a negative one, of institutional and financial development on firm-level investment cash flow sensitivity. It is difficult for us to provide direct evidence to check the rationality of this hypothesis but we can further discuss about the mechanism behind it.

Intuitively, this hypothesis involves three points. First, given better business environment, (private) firms can earn more profits from the more opening market and have higher level of internal funds. Guariglia (2008) detects a U-shaped relationship between investment and cash flow if the sample is split on the basis of the level of internal funds available to the firms. If the development index merely captures the variation of cash flow variable across firms and provinces, then the significant coefficient for the interaction term between cash flow and development index may simply reflect the differential marginal effects of different levels of cash flow. More straightforward, it may have nothing to do with the reduction of external financing constraints. This issue is considered in section 2.6.5 of this chapter. The results presented in Table 2.11 show that this inference is unlikely to be sufficient.

Second, there are roughly three regimes in the conventional pecking order theory of financing, i.e. only internal funds, internal funds plus external debt, and finally new equity issuances. The 'encourage' argument describes a situation in which private firms are on average unable to pursue the highest investment level which should be attainable given the availability of their internal funds. The market oriented reform can release such inhibited amount of investment incentives up to the level suggested by the increasing profits. However, why do our results show a negative impact from regional development on the investment cash flow sensitivity? The reasonable explanation could be that most of private firms in our sample lie between the first and second regimes described by the pecking order theory. Furthermore, it is unlikely that cash flow is the only resource for fixed capital investment of Chinese private firms. Meanwhile, the institutional and financial development is most likely to improve the external credit availability for those private firms and such external credit augmenting effect may dominate the 'encourage' effect.

More intrinsically, this 'encourage' argument is somewhat against the key assumption, applied through the whole chapter, that investment cash flow sensitivity is a valid measurement to the degree of financing constraints faced by Chinese private firms. According to the 'encourage' logic, what has been mitigated is not financial constraints but the high uncertainty in a relatively centralized economy, e.g. government expropriation and policy shocks. Nevertheless, one missing segment in the argument is the role played by the measurement of investment opportunities. Empirically, if the investment opportunities can be correctly measured and the capital market is perfect, then the coefficients for financial variables should not be statistically insignificant. This indicates that the suppression of investment incentives, which is associated with uncertainty, should be reflected by the reduction in the casual connection from investment opportunity measurement to actual investment expenditures rather than the variation in investment cash flow sensitivity. In other words, a positive effect, suggested by the 'encourage' argument, from institutional and financial development on cash flow coefficient may simply indicate that our measurement of investment opportunities is problematic. The reason is simple. Higher level of profitability may indicate higher investment opportunities of firms, which can result in an endogenous issue.

The above discussion again leads us to the fundamental question aroused by empirical testing of financial constraint effect. Can we sufficiently capture firms' investment opportunities? Is investment cash flow sensitivity a meaningful measurement to degree of

financial constraint for Chinese unlisted manufacturing firms? The answer should be positive. We use the Euler equation to address the problem of non-applicable of Tobin's Q. We incorporate the industry, year dummies and their interaction term into the regression model to further capture the fluctuation of aggregated demand. Besides, if people still believe that firms in different provinces/regions can have very different investment opportunities/incentives and such difference cannot be eliminated by first-differencing the investment regression, then we probably must move outside a single regression framework. In the robustness test, section 2.6.1, we estimate the investment model by using the data of firms in each province separately and plot all the cash flow coefficients in one graph along with the Marketization index. A negative relation still exits. If we incorrectly measure investment opportunities, then it is unlikely that we made the mistakes for all firms in all provinces. Lastly, D'Espallier and Guariglia (2012) find that the investment opportunities bias does not affect the variation of investment cash flow sensitivity for small and medium firms. Cull et al. (2015) uses Chinese firms' CEO survey data and finds that the sensitivity of investment to internal cash flows is higher for the unlisted firms that report greater obstacles to obtaining external funds. Therefore, although it is problematic under certain circumstances, investment cash flow sensitivity should still be a valid measurement of degree of financing constraints for Chinese unlisted manufacturing firms.

Another plausible argument is that more profits may attract more institutional corruption which can reduce confidence of private firm on long term commitment for business via investment. A private firm in a province with better development should have higher chance to earn more profits and hence be more reluctant to invest. This 'discourage' argument can be regarded as an alternative hypothesis relative to the 'encourage' argument, which predicts a negative effect from development on investment cash flow sensitivity. Nevertheless, this 'discourage' argument ignores one important point. First, the formatting procedure of the development index itself has already incorporated the government intervention/corruption factor. In Table A.14 in Appendix A of this chapter, we can see that a province with relatively good product and financial markets is unlikely to also have a very bad political sector full of government intervention or serious corruption issue. This is the main reason that we so frequently use the phrase 'institutional and financial development'. In section 2.3.2, we have explicitly discussed about the motivation for us to concentrate on the overall index rather than any other single sub-index. Therefore, this 'discourage' argument may not be very relevant to our major hypothesis.

Lastly, it is reasonable for us to believe that the institutions in China is not worsening during our sample period as time goes by. If investment cash flow sensitivity is indeed a valid measurement of the degree of financing constraints, then we shall see that cash flow coefficient decreases over time when we run regression (2.11) year by year. The results are reported in the Appendix A. In Table A.15, A.16, A.17 and A.18, the cross year OLS estimators for private, state, collective and foreign firms are presented respectively. For private firms, the results in Table A.15 show a slight declining tendency of cash flow coefficient from 0.10 in year 2001 to 0.08 in 2005. However, it increases again after 2005. For state firms, there is no clear moving tendency. More embarrassingly, the investment cash flow sensitivities of state firms are always larger than that of private firms, which probably means that state firms are more financially constrained than private firms. For collective and foreign firms, no specific patterns of cash flow coefficients across years are detected. According to the discussion in section 2.4.6 of this chapter, OLS estimator can produce very biased results due to its inability to capture time invariant unobservable individual effects. The large cross-sectional variation of variables in our sample can make OLS results very unreliable. Therefore, we further report the fixed effects estimator for private, state, collective and foreign firms respectively in Table A.19, A.20, A.21 and A.22[1]. The minimum number of observations required by fixed effects estimator is two years, so we estimate the regression (2.11) by rolling the estimation period starting with 2001-2002 and then 2002-2003 for example. Although there is no necessary to be monotonic, this time, the cash flow coefficient for private firms presents a more obvious declining tendency from 0.08 in sub-period 2001-2002 to 0.02 in sub-period 2006-2007. For state firms, the cash flow coefficient become small in magnitude and statistically insignificant in all sub-periods, though it presents a slightly increasing tendency. For collective firms, the cash flow coefficients also become statistically insignificant in all sub-periods except for sub-period 2002-2003 and there is no clear tendency. For foreign firms, the cash flow coefficient declines from 0.04 in sub-period 2002-2003 to 0.01 in sub-period 2005-2006. Overall, the fixed effects results are largely consistent with the implication from across province analyses in Table 2.5. Therefore, these rough results may indirectly show that the 'discourage' argument is unlikely to be valid here.

[1] We have attempted to use LSDV and Bias-corrected estimators. However, the number of firms is too large in our case, given the current hardware of computer, Stata 13 is always stuck in some point during the estimation. The Bias-corrected estimator usually requires the averaged sample period not less than 10 years. When we only use 3 three years rollover, the final Bias-corrected estimators become very unstable. Therefore, it cannot be used here.

2.7 Conclusion

Can market-oriented reforms and developments reduce the inefficiency of credit allocation in China's capital market? To answer this question, we analyse the effects from institutional and financial development on firm-level financing constraints in China. We combine a panel of over 95,000 Chinese manufacturing firms of different ownership types over the period 2000-2007 with the Index of Marketization for China's Provinces (NERI) during the same time period to investigate whether or not and how cross-regional differences in institutions and financial development can affect the dependence of firms' investment on internal funds (Fazzari et al., 1988). Our main results and the corresponding policy implications are presented below.

Institutional and financial development in China can reduce financing constraints significantly for private firms and partly for foreign firms, while strengthening the financing constraints for state and collective firms. Furthermore, our results indicate that market-oriented reforms and developments in China can promote the investment of firms without government connections more than that of firms with political backgrounds, through the channel of external financing. More specifically, previous literature supports the view that there is a crowding out effect in external financing faced by the large firms without government connections in China (Cull et al., 2015). Using domestic private firms as an example, we firstly confirm this general result and then further discover that institutional and financial development can help medium-sized firms, but not for large-sized firms, to mitigate financing constraints. Nevertheless, after controlling the degree of government connections for those large-sized private firms, we find that regional marketization can reduce financial obstacles for the large-sized private firms without political connections but not for those large-sized firms affiliated with central or local governments. In other words, the crowding out effect in external financing, mainly generated by the political pecking order effects, should be gradually eliminated with the process of marketization in China.

Additionally, we have separately tested the effects from institutions and financial development on the status of financing constraint for the Chinese private firms. Overall, our results indicate that both market related developments and reduction of government intervention in the local economy can lead to decline in the degree of financing constraints faced by private firms. Nevertheless, the former plays a much less important role than the

latter. This means that without deepened separation between government and business sectors, the benefits from financial reforms and liberalizations may be difficult for firms and agencies in the economy to fully capture.

Our empirical results suggest that market-oriented reforms can increase the efficiency of resources allocation in China's capital market. First, this indicates that authorities in China have already begun to shift policies from target-related measures (such as tax favourable to small private firms) towards policies levelling the playing field between firms with and without political privileges, i.e. creating a better business environment with fair competition. Second, previous literature in institution, finance and growth usually holds negative attitudes towards the poor financial and legal systems in China. Most previous studies actually overemphasize the insufficiency, however they overlook the accumulated positive effects presented in the process of gradual reforms. Our paper has filled this gap using firm-level evidence.

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Appendix A

Definitions of the variables used

Fixed capital stock: book value of tangible fixed assets (which include land and building; fixtures and fittings; plant and vehicles).

Fixed investment: difference between the book value of tangible fixed assets at end of year t and at end of year t-1 adding depreciation at year t.

Cash flow: net income plus depreciation.

All variables are deflated back to the price in year 2000.

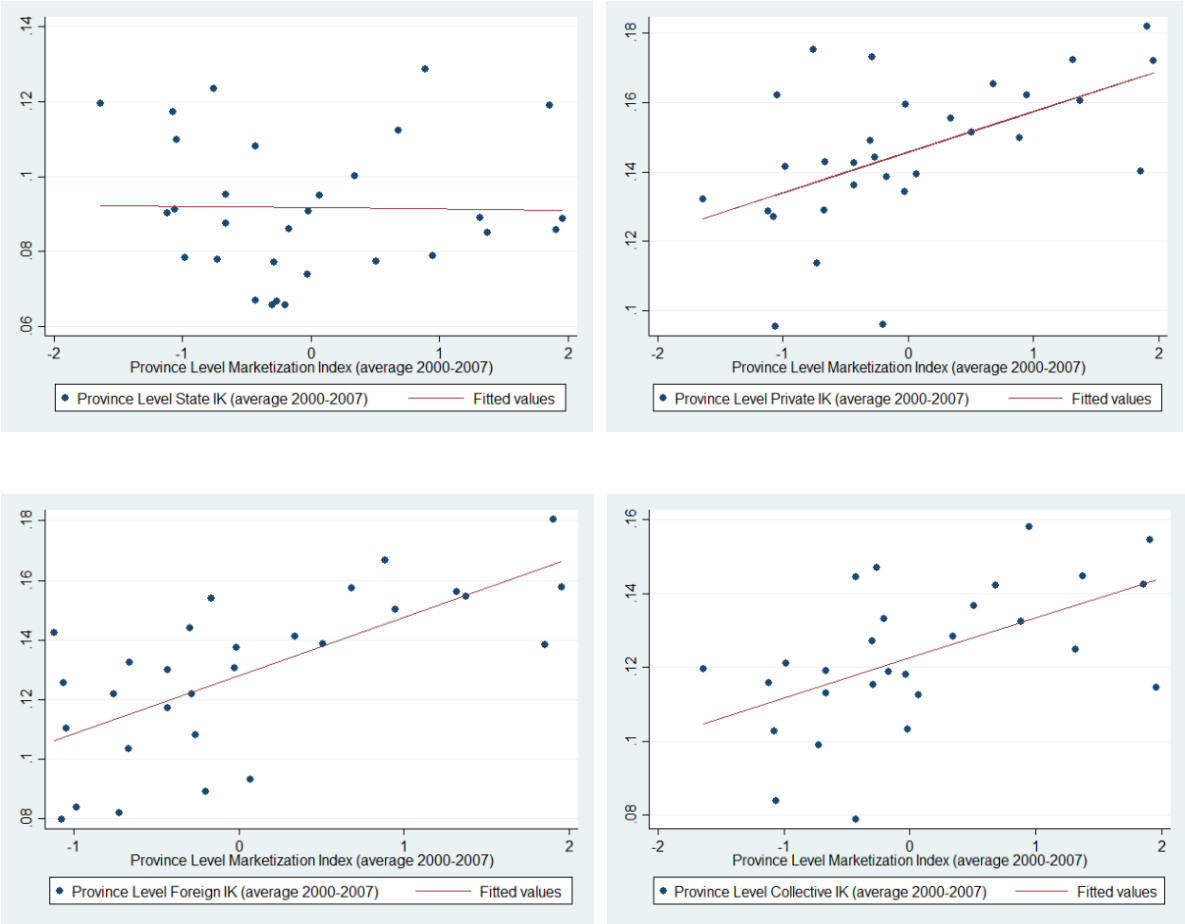

Figure A.2: Fixed capital investment and marketization index

Table A.12: Industry proportions in groups (combined regions) with different levels of development

Level	Metal	Petroleum	Chemical	Machinery	Electrical	Transport	Food	Textile	Leather	Mining
1.68	0.09	0.06	0.16	0.11	0.16	0.04	0.03	0.21	0.10	0.03
0.67	0.07	0.11	0.16	0.13	0.11	0.06	0.05	0.12	0.09	0.10
0.01	0.09	0.15	0.17	0.11	0.08	0.04	0.06	0.10	0.08	0.12
-0.24	0.06	0.16	0.16	0.10	0.07	0.05	0.06	0.09	0.10	0.15
-0.43	0.06	0.13	0.20	0.08	0.06	0.10	0.07	0.05	0.10	0.16
-0.70	0.11	0.17	0.16	0.08	0.04	0.02	0.07	0.04	0.08	0.24
-1.15	0.09	0.17	0.18	0.09	0.06	0.03	0.09	0.05	0.08	0.18

We have separated all provinces and regions into 7 groups. **Level** is the averaged marktization index for this group. Firstly, we ordered the provinces based on the value of marketization index from largest to smallest. Specifically, we start with the province Guangdong which has the value of index at 1.63. We stop at the region Shanghai where has the value of index at 1.59, since the province right after Shanghai is Jiangsu where has the value of index at 1.16. There is a relatively large difference between 1.59 and 1.16. We treat it as a gap. Therefore, provinces and regions, Guangdong, Shanghai, Zhejiang are treated as the first group. The second group starts at province Jiangsu, so on. For each row, there are proportions of different industries within each group. The sum of the proportions in each row is 100%. We have labeled the industries into the above nine categories. This does not mean that we have only considered these nine industries. These nine industries are just the main categories containing many small sorts of industries

Table A.13: Registration code and Political affiliations

Register	NPA	PA	PA%(R)
110	27	1938	98.63%
151	5	201	97.57%
143	6	211	97.24%
120	221	5175	95.90%
142	7	129	94.85%
141	7	71	91.03%
130	864	4231	83.04%
160	539	2188	80.23%
149	31	91	74.59%
159	2992	7322	70.99%
220	52	112	68.29%
190	27	58	68.24%
240	12	25	67.57%
210	810	1203	59.76%
320	46	68	59.65%
340	10	13	56.52%
310	864	1055	54.98%
174	980	308	23.91%
330	36	11	23.40%
230	51	15	22.73%
172	1153	337	22.62%
171	5148	1356	20.85%
173	15367	2269	12.87%

Register: registration information

NPA: number of firms without political affiliation

PA: number of firms with political affiliation

PA%(R): percentage of PA to (PA+NPA)

Chinese private firms can be classified into three groups:
1. Firms privatized from State and collective firms.
Registration code: 110, 120, 151

2. Firms registered as pure private firms.
Registration code: 171, 172, 173, 174

3. Firms registered as other kinds of liabilities.
Registration code: others

Table A.14: Averaged cross-province sub-categories of Marketization index

Province Name	Overall Index	Financial Markets	Non-state Sector	Government Market	Legal Framework	Commodity market
Guangdong	1.96	1.43	1.46	1.02	1.73	1.29
Zhejiang	1.94	1.40	1.69	1.02	1.60	1.20
Shanghai	1.92	1.92	0.85	1.01	2.66	0.23
Jiangsu	1.40	0.96	1.28	1.23	0.91	0.75
Fujian	1.31	1.18	1.18	0.77	0.34	1.26
Tianjin	0.97	1.43	0.58	0.13	1.03	0.12
Beijing	0.93	1.53	0.53	0.59	1.09	-0.66
Shandong	0.69	0.35	0.93	0.39	0.17	0.77
Liaoning	0.53	0.65	0.37	-0.03	0.27	0.65
Chongqing	0.36	0.90	0.24	0.48	-0.38	0.24
Sichuan	0.07	-0.30	0.17	0.53	-0.17	0.31
Anhui	-0.03	-0.50	0.17	0.71	-0.35	0.20
Hebei	-0.05	-0.51	0.17	0.27	-0.24	0.25
Hubei	-0.16	-0.13	-0.25	-0.02	-0.25	0.21
Hainan	-0.24	-0.19	-0.01	0.12	-0.37	-0.56
Henan	-0.27	-0.46	0.20	-0.02	-0.38	-0.29
Hunan	-0.28	-0.06	-0.07	-0.12	-0.56	0.01
Jiangxi	-0.30	-0.47	-0.32	-0.03	-0.51	0.61
Jilin	-0.44	-0.96	-0.33	-0.53	-0.21	0.58
Guangxi	-0.45	-0.75	-0.24	0.64	-0.51	-0.52
Neimenggu	-0.67	-0.86	-0.39	-1.08	-0.32	0.09
Heilongjiang	-0.68	-1.04	-0.74	-0.51	-0.04	0.15
Yunnan	-0.76	-0.29	-0.80	-0.03	-0.61	-0.74
Shanxi	-0.76	-0.67	-0.65	-0.90	-0.35	-0.29
Shaanxi	-1.01	-0.55	-1.04	-0.45	-0.64	-0.99
Xinjiang	-1.04	-0.83	-0.93	-1.33	-0.27	-0.72
Ningxia	-1.07	-0.66	-0.41	-1.14	-0.77	-1.43
Gansu	-1.08	-0.72	-1.52	-0.55	-0.93	-0.32
Huizhou	-1.14	-0.86	-1.16	-0.63	-0.85	-0.41
Qinghai	-1.67	-0.95	-0.96	-1.54	-1.07	-2.02

Table A.15: Private Firms (OLS-Cross Year)

	2001	2002	2003	2004	2005	2006	2007
IK_{it-1}	-0.032***	-0.021**	-0.013*	-0.039***	-0.094***	-0.096***	-0.061***
	(0.009)	(0.009)	（0.007）	(0.007)	(0.006)	(0.007)	(0.007)
IK_{it-1}^2	0.004	0.017***	0.020***	0.019***	-0.003	-0.024***	-0.002
	(0.007)	(0.006)	（0.005）	(0.005)	(0.004)	(0.005)	(0.005)
SRK_{it-1}	0.016***	0.015***	0.015***	0.017***	0.014***	0.012***	0.011***
	(0.000)	(0.000)	（0.000）	(0.000)	(0.000)	(0.000)	(0.000)
CFK_{it-1}	**0.103*** **	**0.099*** **	**0.104*** **	**0.088*** **	**0.079*** **	**0.099*** **	**0.095*** **
	(0.010)	**(0.008)**	**(0.007)**	**(0.007)**	**(0.005)**	**(0.005)**	**(0.005)**
Constant	0.209**	0.008	0.093**	-0.019	-0.095*	-0.051	-0.070
	(0.081)	(0.060)	(0.040)	(0.064)	(0.050）	(0.057)	(0.074)
R-square	0.068	0.067	0.068	0.061	0.072	0.064	0.056
Obs.	16562	23482	34689	40360	52196	49489	45406

Industry and Province effects are controlled in all specifications.
Standard errors are reported in parentheses, * p<0.10, ** p<0.05, *** p<0.01.

Table A.16: State Firms (OLS-Cross Year)

	2001	2002	2003	2004	2005	2006	2007
IK_{it-1}	-0.074***	-0.069***	-0.093***	-0.064**	-0.068***	-0.078***	-0.024
	(0.016)	(0.021)	(0.024)	(0.027)	(0.024)	(0.027)	(0.033)
IK_{it-1}^2	-0.054**	0.002	-0.003	0.014	0.027**	-0.022	0.021
	(0.027)	(0.013)	(0.014)	(0.021)	(0.014)	(0.017)	(0.018)
SRK_{it-1}	0.014***	0.014***	0.010***	0.016***	0.010***	0.012***	0.014***
	(0.002)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)
CFK_{it-1}	**0.149*** **	**0.117*** **	**0.158*** **	**0.121*** **	**0.149*** **	**0.173*** **	**0.114*** **
	(0.019)	**(0.017)**	**(0.018)**	**(0.022)**	**(0.018)**	**(0.020)**	**(0.022)**
Constant	0.056	-0.377***	-0.015	-0.045	-0.089	0.023	0.020
	(0.054)	(0.144)	(0.025)	(0.099)	(0.141）	(0.038)	(0.091)
R-square	0.050	0.047	0.040	0.046	0.053	0.061	0.063
Obs.	6315	7364	8100	6429	5801	4943	3759

Industry and Province effects are controlled in all specifications.
Standard errors are reported in parentheses, * p<0.10, ** p<0.05, *** p<0.01.

Table A.17: Collective Firms (OLS-Cross Year)

	2001	2002	2003	2004	2005	2006	2007
IK_{it-1}	-0.088***	-0.111***	-0.091***	-0.130***	-0.104***	-0.151***	-0.105***
	(0.017)	(0.023)	(0.020)	(0.028)	(0.021)	(0.026)	(0.027)
IK_{it-1}^2	-0.002	-0.038**	-0.014	-0.060**	-0.009	-0.041**	-0.018
	(0.012)	(0.015)	(0.013)	(0.028)	(0.011)	(0.016)	(0.017)
SRK_{it-1}	0.013***	0.012***	0.010***	0.013***	0.014***	0.012***	0.009***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
CFK_{it-1}	**0.086*** **	**0.111*** **	**0.108*** **	**0.110*** **	**0.068*** **	**0.110*** **	**0.106*** **
	(0.016)	**(0.017)**	**(0.013)**	**(0.016)**	**(0.014)**	**(0.013)**	**(0.016)**
Constant	0.228	0.096*	0.225*	-0.562	-0.074*	0.178**	-0.500*
	(0.171)	(0.055)	(0.129)	(0.563)	(0.043)	(0.080)	(0.283)
R-square	0.072	0.069	0.056	0.061	0.085	0.090	0.071
Obs.	5067	6196	7144	5712	5672	4911	4167

Industry and Province effects are controlled in all specifications.
Standard errors are reported in parentheses, * p<0.10, ** p<0.05, *** p<0.01.

Table A.18: Foreign Firms (OLS-Cross Year)

	2001	2002	2003	2004	2005	2006	2007
IK_{it-1}	-0.048***	-0.066***	-0.042***	-0.067***	-0.085***	-0.089***	-0.090***
	(0.018)	(0.017)	(0.015)	(0.015)	(0.012)	(0.015)	(0.016)
IK_{it-1}^2	-0.011	-0.012	-0.012	0.000	-0.015*	-0.007	-0.029**
	(0.020)	(0.013)	(0.011)	(0.010)	(0.007)	(0.010)	(0.011)
SRK_{it-1}	0.009***	0.009***	0.011***	0.012***	0.011***	0.008***	0.008***
	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
CFK_{it-1}	**0.072*** **	**0.078*** **	**0.073*** **	**0.093*** **	**0.057*** **	**0.086*** **	**0.082*** **
	(0.012)	**(0.009)**	**(0.009)**	**(0.008)**	**(0.008)**	**(0.007)**	**(0.008)**
Constant	-0.001	0.135**	0.133***	0.018	-0.510***	0.161	0.017
	(0.022)	(0.068)	(0.014)	(0.018)	(0.015)	(0.049)	(0.091)
R-square	0.042	0.053	0.056	0.059	0.056	0.050	0.049
Obs.	6407	8918	11188	12525	14681	13903	12690

Industry and Province effects are controlled in all specifications.
Standard errors are reported in parentheses, * p<0.10, ** p<0.05, *** p<0.01.

Table A.19: Private Firms (Fixed effects)

	2001-2002	2002-2003	2003-2004	2004-2005	2005-2006	2006-2007
IK_{it-1}	-0.361***	-0.398***	-0.399*	-0.490***	-0.391***	-0.420***
	(0.009)	(0.009)	(0.008)	(0.007)	(0.006)	(0.006)
IK_{it-1}^2	0.081***	0.028**	0.038***	0.075***	-0.012*	-0.036***
	(0.013)	(0.012)	(0.010)	(0.008)	(0.007)	(0.008)
SRK_{it-1}	0.047***	0.045***	0.045***	0.037***	0.042***	0.041***
	(0.002)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)
CFK_{it-1}	**0.079*** **	**0.065*** **	**0.063*** **	**0.032*** **	**0.054*** **	**0.020****
	(0.017)	**(0.015)**	**(0.013)**	**(0.007)**	**(0.008)**	**(0.008)**
Constant	-0.015	-0.097**	-0.060**	-0.276***	-0.056	-0.264**
	(0.052)	(0.040)	(0.074)	(0.065)	(0.058)	(0.109)
R-square	0.351	0.332	0.306	0.442	0.345	0.367
Obs.	40035	58165	75049	92556	101685	94895

Year dummies and the interaction between year and industry dummies are controlled in all specifications. Standard errors are reported in parentheses,
* p<0.10, ** p<0.05, *** p<0.01.

Table A.20: State Firms (Fixed effects)

	2001-2002	2002-2003	2003-2004	2004-2005	2005-2006	2006-2007
IK_{it-1}	-0.360***	-0.502***	-0.534***	-0.556***	-0.460***	-0.449***
	(0.016)	(0.022)	(0.025)	(0.023)	(0.022)	(0.027)
IK_{it-1}^2	0.128***	0.005	0.018	0.066**	0.007	0.009
	(0.026)	(0.027)	(0.028)	(0.027)	(0.027)	(0.032)
SRK_{it-1}	0.060***	0.042***	0.045***	0.034***	0.047***	0.053***
	(0.006)	(0.005)	(0.005)	(0.004)	(0.004)	(0.005)
CFK_{it-1}	**-0.052**	**-0.012**	**0.021**	**0.016**	**0.044**	**0.018**
	(0.032)	**(0.026)**	**(0.030)**	**(0.030)**	**(0.030)**	**(0.044)**
Constant	-0.126***	-0.134***	-0.205***	-0.156	-0.388**	-0.219**
	(0.031)	(0.043)	(0.072)	(0.124)	(0.168)	(0.092)
R-square	0.312	0.279	0.309	0.387	0.333	0.308
Obs.	13672	15460	14529	12230	10744	8702

Year dummies and the interaction between year and industry dummies are controlled in all specifications. Standard errors are reported in parentheses,
* p<0.10, ** p<0.05, *** p<0.01.

Table A.21: Collective Firms (Fixed effects)

	2001-2002	2002-2003	2003-2004	2004-2005	2005-2006	2006-2007
IK_{it-1}	-0.399***	-0.457***	-0.449***	-0.562***	-0.415***	-0.501***
	(0.018)	(0.019)	(0.025)	(0.022)	(0.020)	(0.021)
IK_{it-1}^2	0.064**	0.011	-0.014	0.080***	-0.008	-0.018
	(0.027)	(0.024)	(0.028)	(0.022)	(0.024)	(0.030)
SRK_{it-1}	0.040***	0.039***	0.044***	0.029***	0.044***	0.033***
	(0.003)	(0.003)	(0.039)	(0.003)	(0.003)	(0.003)
CFK_{it-1}	**0.003**	**0.055****	**0.051**	**0.029**	**0.016**	**0.039**
	(0.031)	**(0.025)**	**(0.031)**	**(0.026)**	**(0.022)**	**(0.027)**
Constant	-0.343*	-0.131	-0.345**	0.094	0.246	-0.280*
	(0.180)	(0.083)	(0.159)	(0.141)	(0.447)	(0.152)
R-square	0.332	0.336	0.281	0.476	0.362	0.380
Obs.	11261	13339	12856	11384	10583	9078

Year dummies and the interaction between year and industry dummies are controlled in all specifications. Standard errors are reported in parentheses,
* p<0.10, ** p<0.05, *** p<0.01.

Table A.22: Foreign Firms (Fixed effects)

	2001-2002	2002-2003	2003-2004	2004-2005	2005-2006	2006-2007
IK_{it-1}	-0.431***	-0.471***	-0.504***	-0.547***	-0.444***	-0.473***
	(0.017)	(0.015)	(0.016)	(0.013)	(0.012)	(0.014)
IK_{it-1}^2	0.065**	-0.017	0.016	0.033*	-0.027	-0.006
	(0.031)	(0.024)	(0.024)	(0.018)	(0.016)	(0.020)
SRK_{it-1}	0.043***	0.035***	0.038***	0.032***	0.039***	0.034***
	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)
CFK_{it-1}	**0.013**	**0.039****	**0.035****	**0.028****	**0.013**	**0.027****
	(0.018)	**(0.017)**	**(0.014)**	**(0.011)**	**(0.011)**	**(0.012)**
Constant	-0.010	-0.040	-0.202**	-0.172	0.044	-0.254**
	(0.031)	(0.036)	(0.094)	(0.457)	(0.079)	(0.117)
R-square	0.356	0.321	0.325	0.429	0.341	0.327
Obs.	15325	20106	23713	27206	28584	26593

Year dummies and the interaction between year and industry dummies are controlled in all specifications. Standard errors are reported in parentheses,
* p<0.10, ** p<0.05, *** p<0.01.

Table A.23: Multicollinearity test for specification in Table 2.4

Panel A

Variables	VIF	SQRT VIF	Tolerance	R-Squared
IK_{it-1}	1.34	1.16	0.743	0.256
IK_{it-1}^2	1.34	1.16	0.745	0.254
SRK_{it-1}	1.30	1.14	0.771	0.229
CFK_{it-1}	2.01	1.42	0.497	0.503
$CFK_{it-1} * D_p$	1.80	1.34	0.554	0.445
Mean VIF	**1.56**			

Panel B

Dimension	Eigenvalue	Cond Index
1	3.0496	1.0000
2	1.3967	1.4776
3	0.6708	2.1322
4	0.4318	2.6576
5	0.2405	3.5607
6	0.2105	3.8062
Condition Number	**3.8062**	

Table A.24: Multicollinearity test for specification in Column (2) of Table 2.6

Panel A

Variables	VIF	SQRT VIF	Tolerance	R-Squared
IK_{it-1}	1.35	1.16	0.743	0.256
IK_{it-1}^2	1.34	1.16	0.745	0.254
SRK_{it-1}	1.30	1.14	0.769	0.230
$CFK_{it-1} * PA_{it}$	1.70	1.30	0.587	0.412
$CFK_{it-1} * (1 - PA_{it})$	2.63	1.62	0.380	0.619
$CFK_{it-1} * PA_{it} * D_p$	1.50	1.22	0.667	0.333
$CFK_{it-1} * (1 - PA_{it}) * D_p$	2.41	1.55	0.416	0.584
Mean VIF	**1.75**			

Panel B

Dimension	Eigenvalue	Cond Index
1	2.9928	1.0000
2	1.6478	1.3477
3	1.3962	1.4641
4	0.7714	1.9697
5	0.4507	2.5768
6	0.3239	3.0398
7	0.2344	3.5734
8	0.1829	4.0456
Condition Number	**4.0456**	

Table A.25: Multicollinearity test for specification in Column (2) of Table 2.7 (Private firms)

Panel A

Variables	VIF	SQRT VIF	Tolerance	R-Squared
IK_{it-1}	1.35	1.16	0.742	0.258
IK_{it-1}^2	1.34	1.16	0.745	0.255
SRK_{it-1}	1.35	1.16	0.743	0.257
$CFK_{it-1} * (1 - Large_{it})$	2.19	1.48	0.4576	0.5424
$CFK_{it-1} * (1 - Large_{it}) * D_p$	1.89	1.37	0.5295	0.4705
$CFK_{it-1} * Large_{it}$	2.47	1.57	0.4050	0.5950
$CFK_{it-1} * Large_{it} * D_p$	2.42	1.55	0.4138	0.5862
Mean VIF	**1.86**			

Panel B

Dimension	Eigenvalue	Cond Index
1	3.0498	1.0000
2	1.8016	1.3011
3	1.3830	1.4850
4	0.6694	2.1344
5	0.4282	2.6687
6	0.2517	3.4811
7	0.2093	3.8173
8	0.2070	3.8387
Condition Number	**3.8387**	

Further sample description:

In this Chapter, we mainly rely on the dataset drawn from the annual accounting reports filed by industrial firms with the National Bureau of Statistics (NBS) over the period 2000-2007. There are at least three advantages for us to use this unique dataset. First, this NBS dataset is very representative to actual situation of Chinese non-financial firms. Almost 100,000 unlisted firms operate in the manufacturing and mining sectors and come from 30 provinces or province-equivalent municipal cities. Second, heterogeneity in behaviours among different types of firms can be intensively investigated, since this micro-dataset elaborately contains the cross-sectional variation of variables. Lastly, it includes a large proportion of medium and young firms which are particularly likely to suffer from constraints in external financing.

Table A.26: Sample observations distributions by year and ownership types

Year	Full sample	State firms	Private firms	Collective firms	Foreign firms
2000	36697	6315	16562	5067	6407
2001	48894	7364	23482	6196	8918
2002	64403	8100	34689	7144	11188
2003	77175	8544	44108	7733	13194
2004	85448	6801	53894	6345	15260
2005	81301	5801	52196	5672	14681
2006	75892	4943	49489	4911	13903
2007	68397	3759	45406	4167	12690

We classify the firms into 'state owned', 'foreign', 'private', and 'collective'[42], based on the majority average shares of paid-in-capital contributed by our four types of investors in each year.

Table A.27: The number of firms with 4 to 6 years continuous observations

Number of continuous observations	Frequency	Percent
4	31385	33%
5	16870	18%
6	15915	17%
7	11197	12%
8	19306	20%

The number 4 in first columns means that a firm has 4 years continuous observations.

[42] Collective firm is usually controlled by local governments.

Table A.28: Industry distributions (by observations)

	Full sample	State Firms	Private Firms	Collective Firms	Foreign Firms
Metal and Metal products	44,376	2,707	28209	4,813	6893
Non-metal products	53,452	5,868	33969	6,678	4444
Chemical and Plastic	89,105	6,898	54,414	7,664	15999
Machinery and Equipment	61,175	6,764	39,877	5,151	7114
Electrical equipment	65,961	3,934	3,5500	4,036	19828
Transport equipment	25590	3,254	14,948	2,311	3702
Food and Tobacco	23270	3,798	12,352	1,415	4407
Textile	80696	2,922	49,085	5,222	20184
Leather and Timber	51154	5,871	28,476	4,529	10224
Mining and Logging	43392	9,600	22,977	5,413	3446

Table A.29: Other useful variables included in the NBS dataset

	Full sample	State firms	Private firms	Collective firms	Foreign firms
Total assets	124	376	84	47	140
	[967]	[2580]	[517]	[275]	[552]
Total assets growth	0.08	0.001	0.10	0.04	0.07
	[0.32]	[0.25]	[0.33]	[0.30]	[0.30]
Number of Employee	422	1124	311	302	467
	[1843]	[4134]	[943]	[738]	[1005]
Employment growth	0.014	-0.06	0.02	-0.02	0.05
	[0.36]	[0.35]	[0.36]	[0.35]	[0.36]
Sales	119	258	87	54	159
	[928]	[1953]	[640]	[368]	[715]
Sales growth	0.11	0.04	0.13	0.06	0.11
	[0.44]	[0.48]	[0.44]	[0.43]	[0.42]
Investment ratio	0.09	0.03	0.11	0.06	0.09
	[0.37]	[0.34]	[0.38]	[0.37]	[0.33]
Cash flow ratio	0.27	0.09	0.28	0.29	0.31
	[0.35]	[0.25]	[0.34]	[0.38]	[0.39]
Liquidity	0.03	-0.09	0.02	0.03	0.13
	[0.31]	[0.39]	[0.28]	[0.34]	[0.28]
Leverage	0.58	0.72	0.59	0.62	0.47
	[0.29]	[0.39]	[0.26]	[0.33]	[0.26]
Collateral	0.37	0.43	0.36	0.37	0.34
	[0.19]	[0.20]	[0.19]	[0.20]	[0.17]
Age	12.77	29.67	10.68	17.29	8.56
	[0.19]	[17.73]	[10.81]	[11.89]	[3.75]
Export to total assets	0.21	0.05	0.16	0.09	0.53
	[0.40]	[0.34]	[0.33]	[0.30]	[0.51]
Export dummy	0.35	0.17	0.29	0.16	0.73
	[0.47]	[0.38]	[0.45]	[0.36]	[0.44]
Observations	538207	51627	319826	47235	96241

Total assets and sales are expressed in RMB million. Leverage is defined as total liabilities divided by total assets. No information about financial debt is available. All variables are deflated back to year 2000 by using CPI index. The sample average values of variables are reported. The standard deviations are reported in brackets.

Chapter 3

Ownership structures and Leverage adjustments: Evidence from Chinese listed firms

3.1 Introduction

In 2014, China has one of the highest corporate debt-to-GDP ratios in the world, even compared to major developed economies such as the United States (Huang and Bosler, 2014). Many studies argue that government support has driven the increase in China's corporate indebtedness and has channelled a large amount of credits into inefficient state-owned enterprises (SOEs).[43] Therefore, it is worrisome that the asymmetric credit expansion may further push the leverage of these firms into levels far beyond a sustainable boundary. Furthermore, weak legal protections for investors result in severe expropriation behaviours of controlling shareholders towards minority shareholders in China's stock market. The spread of such agency costs may substantially increase the premium required by external creditors in the whole economy, which in turn impedes firms to quickly optimize their capital structures through large securities issuances. In this chapter, therefore, using the Chinese listed firms (CLFs) dataset, we explore the exact role played by state ownership and controlling shareholders in determining firms' dynamic capital structure decisions.

The classical trade-off theory of capital structure suggests that a value maximizing firm should borrow towards an optimal point which is defined by balancing the bankruptcy costs of debt and the tax advantages of debt (Myers, 1984). Given market imperfections, however, firms cannot always stay at their optimal leverage levels. Instead, they take positive steps to offset deviations from optimums. Empirically, the standard partial adjustment model has been widely applied to estimate the speed of leverage adjustment by using the US firms dataset. Nevertheless, the unexpectedly low adjustment speed, ranging from 7% (Fama and French, 2002) to 36% (Flannery and Rangan, 2006) per year, has aroused researchers' attention to the existence of possible large leverage adjustment costs which can result in a longer refinancing cycle and hence a slower adjustment speed (e.g., Fischer et al., 1989; Leary and Roberts, 2005; Strebulaev, 2007). Therefore, western literature usually anticipate that firms with lower costs of adjustment tend to adjust their leverage ratios towards optimal levels faster.

In this chapter, we argue that the costs of leverage adjustment are likely to vary across firms with different ownership types. More specifically, opposite to the prediction in the dynamic trade-off theory, the relatively low costs of adjustment brought by the preferential

[43] See, e.g. Standard Chartered (2014); Zhang et al. (2015)

treatment in the banking sector as well as the debt market may not motivate SOEs to adjust their leverage ratios towards optimal levels more actively but instead reduce the importance of eliminating deviations from optimal leverage levels in their financing decisions. Additionally, SOEs may lower incentives to use interest expenses of debt to shield against corporate income tax (Chen, 2004). Therefore, SOEs should on average have lower leverage adjustment speed towards the optimal level than the firms with other ownership types, e.g. privately owned firms.

Furthermore, we argue that managers' incentives to adjust the firms' capital structures can also be associated with the controlling power of the firms' dominating shareholders. The monitoring benefits (expropriation risks) brought by a controlling shareholder should be positively (negatively) correlated with the amount of ownership stakes concentrated in his or her hands (La Porta et al., 1999 and Betrand et al., 2002). Perceiving the risks of being expropriated, poorly protected creditors may avoid lending to firms with complex ownership structures (La Porta et al., 1997; 2002). Consequently, a firm with complex ownership structures or lower ownership concentration should face higher costs of leverage adjustment and present lower converging speed towards its target ratios. In contrast, a firm with less complex ownership structure or higher ownership concentration is likely to be offered more flexible choices in terms of external debt financing as it may be considered a much safer borrower. Besides, if optimal leverage converging behaviour is a sort of value maximizing policy, then the large controlling shareholders who own a higher level of ownership stakes are more likely to adjust the firm's leverage ratio from deviations towards optimal levels, thereby maximizing their own values.

Additionally, we argue that the incentives of large shareholders are likely to vary between SOEs and non-SOEs, e.g. privately-owned enterprises (POEs). Generally speaking, the increasing level of ownership stakes should make the benefits (costs) of approaching optimal leverage levels become larger (lower) for the non-state controlling shareholder than for the state controlling shareholder. In other words, the positive connection between leverage adjustment speed and ownership concentration should be more significant in POEs than in SOEs. First, private shareholders have higher incentives to be involved in the firms' value maximizing decisions than the state shareholders. Owning a higher level of cash rights, they should take the deviations from optimal leverage more seriously as the systematic deviations may dampen their own value. On the other hand, the benefits from expropriation of minority shareholders should also be higher for

private controllers than for state controllers, since the state is not literally a person who can directly or personally benefit from tunnelling (Jiang et al. 2010). If the private controllers having lower cash rights are believed to have stronger built-in incentives to perform expropriation, then they should face higher costs of being excessively levered as well as higher costs of increasing leverage through large borrowing, and hence encounter more difficulty in adjusting their leverage ratios.

In regression analysis, we estimate a one-stage reduced dynamic leverage model (Flannery and Rangan, 2006). The prominent part of our empirical work is that we apply five different advanced estimators in order to solve the endogeneity, unobservable heterogeneity, instrument manipulation and fractional dependent variable issues in the dynamic panel data model, using financial variables. Therefore, our estimated range of adjustment speed (25% - 30% per year) for CLFs should be very reliable. Generally, our results indicate that the trade-off theory has reasonable explanatory power for the leverage changes of CLFs. In terms of the ownership effects, we use the sample separation tests to discover the variations of the overall adjustment speed across the groups of firms with different ownership types as well as different concentration levels. Our results show that SOEs present lower overall adjustment speed of leverage than POEs. Also, the firms with higher level of ownership concentration present higher leverage adjustment speed towards optimal leverage. This positive relation is stronger in POEs than in SOEs. Our major hypotheses are still valid in robustness check.

Our research contributes to previous literature in several aspects. First, previous studies using Chinese listed firms dataset have tested whether or not state ownership can affect firms' leverage choices but have obtained very mixed results (e.g. Chen, 2004; Huang and Song, 2006; Liu et al., 2011). The major limitation of these studies is that they merely concentrate on the leverage level. In China's capital market, it is common sense that the costs of capital can vary dramatically across firms with different ownership types. Given low costs of debt, for example, it is natural for SOEs to use more debts and maintain a relatively high level of leverage ratio. This indicates that the observed higher or lower value of leverage for a Chinese firm with a certain type of ownership, e.g. a SOE, at normal times, may itself convey limited information about the actual efficiency of the firm's financial decisions. Based on this implication, we choose to focus on the firms' leverage adjustment behaviours rather than on their static leverage in levels. The intuition

is simple. A more efficient and value maximizing firm should be more active in eliminating deviations from its optimal leverage.

Second, we explore the effects of ownership concentration on a firm's capital structure decisions. More specifically, studying firms in the US and UK with quite diffused ownership structures, traditional literature focus on the effects of manager-shareholder conflicts on firms' financing behaviours (e.g., Jensen and Meckling, 1976; Grossman and Hart, 1980; Jensen, 1986). In many other developed and developing economies, however, ownership is commonly concentrated in hands of a few large shareholders, e.g. Western Europe (La porta et al., 1999 and Faccio and Lang, 2002) and East Asian (Claessens et al., 2000). Before our research, it was still unclear whether or not the presence of such concentrated ownership structure for the firms in the developing economy can result in some particular capital structure decisions different from those of the US firms.

Lastly, we reconcile the debate about whether or not CLFs should maintain the ownership structure with blockholders. The expropriation behaviours from controlling shareholders to minority shareholders are found to be very severe in China's stock market. Nevertheless, it is still difficult for scholars to conclude that large shareholders are harmful to the performances of CLFs. Based on the opinion of Demsetz and Lehn (1985) and Shleifer and Vishny (1997), large shareholders can monitor managers' behaviours in an economy that has weak legal protection for investors. This affords a possible value enhancing role for those large shareholders in CLFs, since the poor legal institutions in China are almost universally recognized. Some previous literature has attempted to answer this question by analysing the relationship between large shareholders and firm performances. Nevertheless, different measurements of 'performances' can lead to opposite results. To bypass this issue, we choose to directly analyse the impact of the largest shareholder on a firm's value maximizing behaviour, i.e. optimal leverage targeting behaviours. The results show that the presence of the largest shareholders may be able to enhance the value of both SOEs and POEs, but their influence should be larger for POEs.

The structure of this paper follows: Section 2 is the literature review. Section 3 describes the Chinese background. Section 4 develops our working hypotheses. Section 5 explains the standard partial adjustment model, our empirical designs and the corresponding estimation methods. Section 6 provides data descriptions and some stylized

facts. Section 7 reports the regression results. Section 8 conducts robustness tests. Section 9 concludes our main findings.

3.2 Literature review

3.2.1 Trade-off theory and leverage adjustment

In the conventional static trade-off theory of capital structure, the costs of debt include financial distress (Scott, 1976); personal taxes (Miller, 1977); debt overhang (Myers, 1977) and agency problems (Jensen and Meckling, 1976), while the benefits of debt primarily include tax savings (Kraus and Litzenberger, 1973) and forcing mangers to operate efficiently (Jensen, 1986). Choosing the optimal leverage ratio by balancing these costs and benefits of debt can enhance the value of firms, (Frank and Goyal, 2007). Due to costs of adjustment, however, firms cannot always stay at their optimal leverage levels.[44] Instead, they take positive steps to offset deviations from optima. To estimate the converging speed of leverage for an average firm, the mainstream literature applies the standard partial adjustment model using the deviations from optimal leverage levels to explain the variations of actual leverage ratios (Fama and French, 2002 and Flannery and Rangan, 2006). Nevertheless, using the US firm-level dataset, the estimated speed of adjustment is unexpectedly low, ranging from 7% to 36% per year (Chang and Dasgupta, 2009).

One important explanation is that adjustment costs may have a much larger impact on firms' dynamic capital structure decisions than the seminal theory expected. For examples, Fischer et al. (1989) argue that even small recapitalization costs can lead to wide swings in a firm's debt ratio over time. Leary and Roberts (2005) find that adjustment costs can substantially reduce the probability of active rebalancing towards optima after large equity and debt shocks. Strebulaev (2007) proves that firms only adjust their capital structures at refinancing points and, the larger the adjustment costs are, the longer the refinancing cycles should be.[45] Byoun (2008) notices that over-levered firms with financial surplus and under-levered firms with financial deficits tend to adjust their leverage ratios towards optimal levels more quickly, since the adverse selection/ transaction costs are higher for

[44] In the static trade-off theory, costs of adjustment are not a first-order concern. Nevertheless, in reality, firms are usually forced into long excursions away from their optimal ratios (Myers, 1984). One highly possible explanation to the observed wide variation in actual debt ratios is the existence of large adjustment costs. The standard partial adjustment model is intuitively supported by the effects from adjustment costs.

[45] That is to say, if the firm faces very large adjustment costs, its manager will wait a longer time before adjustment until the benefits of movement can finally offset the costs of movement.

equity than they are for debt. Byoun also indicates that the low overall adjustment speed obtained by previous studies may be the outcome of ignoring asymmetric adjustment behaviours caused by the variations of adjustment costs when firms are being over and under-levered.

3.2.2 The role of ownership structures

3.2.2.1 Manager-shareholder conflicts

Ownership structures are characterized by degrees of conflicts among different stakeholders. Studying firms in the US and the UK with quite diffused ownership structures, traditional literature concentrates on manager-shareholder conflicts, since managers usually have considerable discretion and are likely to pursue their own interests rather than the interests of owners (Jensen and Meckling, 1976 and Grossman and Hart, 1980). Jensen (1986) shows that corporate debt can be an internal mechanism restraining the empire building incentives of managers, since bonding interest payments can prevent managers from wasting free cash flow on unprofitable projects or organizational inefficiencies. Friend and Lang (1988) suggest that self-entrenched managers have incentives to lower their own non-diversifiable risks[46] by decreasing the firms' debt levels which therefore cannot be increased without the non-managerial principal shareholder's participation.[47] These results indicate that large shareholders can increase firms' operating efficiency by raising leverage ratios. If such benefits of debt can offset the costs of losing advantageous investment choices, then there will be an optimal capital structure maximizing value of shareholders (Stulz, 1990).

In terms of leverage adjustment, Morellec et al. (2012) develop a dynamic model to show that increasing manager-shareholder conflicts can widen the rebalancing range of leverage ratios and hence reduce adjustment speed of leverage. Their calibration results show that the cost of debt to managers is three times the cost of debt to shareholders, with more than half of this cost coming from the disciplining effect of debt. Although the manager-shareholder conflict may not necessarily increase refinancing/ adjustment costs, it instead lowers managers' target leverage levels and reduces their incentives to adjust. In their empirical part, Morellec et al. use the index measuring quality of corporate

[46] Amihud and Lev (1981) show that corporate managers have undiversified human capital investment specific to the firms.
[47] This intuition has been further confirmed by Morellec (2004).

governance to proxy severity of firm-level agency conflicts and find that the firms with weak corporate governance tend to adjust their leverage ratios slower.

3.2.2.2 Controlling-minority shareholder conflicts

In many other developed and developing economies, however, ownership is commonly concentrated in hands of a few large shareholders, e.g. Western Europe (La porta et al., 1999 and Faccio and Lang, 2002) and East Asian (Claessens et al., 2000). The manager-shareholder conflicts can be addressed by the presence of large shareholders who both have a general interest in profit/ value maximization and enough control over the assets of the firm to have their interest respected (Shleifer and Vishny, 1986). Nevertheless, if large shareholders own equity with superior voting rights or they control the firm through a pyramid structure, it is possible for them to expropriate other/ minority investors (see, e.g. Stulz, 1988; Shleifer and Vishny, 1997; Ellul, 2008). Especially in the countries with weak legal protection of creditors, a greater separation of cash flow rights from control rights can encourage controlling shareholder at the upside of the pyramid system to use excessive debts to expropriate resources from downside debt-holders (Faccio et al., 2010).[48] In this situation, the controlled firms do not share any upside gains but have to endure all the default risks caused by over indebtedness. Perceiving such risks of expropriation, poorly protected creditors may avoid lending to firms with complex ownership structures (La Porta et al., 1997, 2002). Based on this statement, Lin et al., (2011) find that the cost of debt financing, measured by loan spreads, is significantly higher for the company with a largest ultimate owner having greater excess control rights. Therefore, such firms may be more reluctant to adjust their leverage ratios towards optimal levels due to higher costs of adjustment, including higher costs of entering debt markets and higher variant costs of borrowing.[49]

In addition, literature in price information argue that concentrated ownership structure with large shareholders can increase information asymmetries in the stock market by reducing liquidity (Holmstrom and Tirol, 1993 and Bhide, 1993). Those large shareholders

[48] Using data in G7 countries, Paligorova and Xu (2012) confirm that ultimate owners inflate debt in their affiliates for the purpose of expropriation. Unlike Faccio et al. (2010), they reject some other possible explanations for the existence of higher leverage in pyramids, such as disciplining mechanism, tax-reduction and risk-diversification.

[49] Although large creditors such as banks may have abilities of monitoring, the moral hazard activities by the controlling shareholder in pyramids are usually very difficult to detect and even banks can face high costs of monitoring.

are usually believed to be privately informed traders. Differences in the composition of information between public and private information increase the cost of capital since uninformed investors demand higher return to hold stocks with greater private information (Easley and Ohara, 2004). This is also associated with the adverse selection effect, described by Myers and Majluf (1984), on the costs of equity financing. Therefore, the firms with ownership structure dominated by blockholders may find it more difficult to reduce leverage ratio through large equity issuance. Based on this inference, Kasbi (2009) find that the firms in Western Europe countries with a single majority shareholder adjust at a slower rate.

3.2.2.3 Capital structure decisions of Chinese listed firms

Studies of capital structure for Chinese firms have been few until the last decade. Using CLFs dataset (1994 – 2000), Chen (2004) firstly finds that conventional firm-specific factors determining capital structure in developed economies are also relevant in China but present coefficients with ambiguous signs. Huang and Song (2006) extend the sample size to 1200 listed firms (1994 – 2003) and conclude that the trade-off theory dominates pecking order theory in explaining capital structures of Chinese firms. Taking advantage of the updated dataset (2002 – 2009) with more detailed corporate governance information, Liu et al. (2011) systematically test the effects from ownership structures on leverage decisions of CLFs. They find that state ownership is positively associated with leverage and political connections are important for non-state owned firms to obtain bank loans. Furthermore, the relation between the largest shareholding and leverage ratios is negative for SOEs and it becomes non-linear in non-state owned firms. Besides, they find that institutional development can reduce government intervention as well as diversify the financial resources for CLFs.[50]

The leverage adjustment behaviour of CLFs has aroused scholars' attention only in very recent years. For example, using a small dataset (1999 – 2004), Qian et al. (2009) firstly estimate a standard partial adjustment model and find an average adjustment speed equal to 18% per year. Jiang et al. (2013) find that higher local bank competition in China can increase leverage adjustment speed of under-levered firms by improving their access to bank debt. This phenomenon should be more prominent for small and non-state owned

[50] They adopt the marketization index for China's provinces, complied by Fan et al. (2009), to measure the degree of institutional development.

firms. Guo et al. (2015) test the effects of China's Split-share Structure Reform in 2005-2006 on financing behaviours. They interpret the increasing leverage adjustment speeds of CLFs as the outcome of agency conflicts reduction after the reform.[51] Jin and Kumbhakar (2015) apply a semi-nonparametric model to predict individual specific adjustment speed as a function of firm-level characteristics.[52] They find that the CLFs with higher managerial compensations are more likely to adjust leverage ratios faster towards optima. The firms with higher adjustment speed of leverage also tend to have better performance, but it is unclear whether or not there is a casual relationship.

There are several limitations in the above mentioned studies on leverage adjustment using the CLFs dataset. First, the insufficient consideration of potential econometric issues in estimating the dynamic panel data model using financial variables can result in biased calculation of the leverage adjustment coefficient. Therefore, the implications from the results of these Chinese studies can be problematic. Second, there is no coincident result about the effects of state ownership on leverage adjustment behaviours. The most likely reason is that the previous literature uses inappropriate measurement of the presence of state ownership in CLFs. Lastly, to best of our knowledge, no study provides systematic analysis about the role played by large shareholders in determining firms' dynamic capital structure decisions. We further discuss these issues in the following sections.

3.3 Ownership structure of CLFs

Contrasting with publicly listed firms in developed economies, CLFs are established and grow up in totally different legal, social and institutional environments. Therefore, it is necessary for us to firstly introduce the major characteristics of ownership structures of CLFs.

3.3.1 Government intervention

[51] Guo et al. (2015) indicate that Chinese listed firms have tended to use less debt to finance their financial deficits after the reform in 2007. Nevertheless, 2007-2008 was also the global financial crisis period when the concurrence of Chinese government's financial stimulation and the credit tightening in the local capital market may have forced the external financing choices of listed firms to vary dramatically.

[52] Although there is no significant difference between the averaged values of constant speed and their parametrized speed, the kernel density of their estimator is substantially right allocated near 0.20 comparing with the position of the conventional estimator.

Privatization of state-owned sectors in the Chinese economy began in the late 1980s. The slogan adopted by the Communist Party to describe the proposed reforms was "Grasp the large, let go of the small". Many unprofitable, inefficient small and medium sized SOEs were sold to non-state investors or directly went into bankruptcy while the major businesses of the very largest SOEs were partially privatized through share issue along with the establishment of the Shanghai Stock Exchange (1990) and the Shenzhen Stock Exchange (1991). Therefore, almost all of listed firms were former SOEs before 2000 (Sun and Tong, 2003).

During this process, the shares of listed firms were classified into different categories, mainly state shares, legal person shares, and A-shares.[53] To avoid loss of state assets, the Chinese government occupied all state shares and most legal person shares through its bureaucratic agencies and, by law, these shares were restricted from trading on the secondary market. In contrast, A-shares were widely traded and held by all other public and individual investors (minority shareholders). At the end of 2004, 64% of the total shares in the stock markets were non-tradable and almost 80% listed firms had governments, either central or local, as their ultimate controllers.

3.3.2 Concentrated ownership

Another distinct feature of CLFs is that they often have a single dominant shareholder whose ownership far exceeds that of the second largest shareholder. During 1999 – 2004, on average, the first largest shareholder owned shares exceeded those of the second largest shareholder by around 36% (Chen et al., 2009). The median percentages of shares held by the first largest shareholder and the first five largest shareholders are 36% and 49%, respectively. La Porta et al. (1999) use a 20% share ownership cutoff to identify the existence of controlling shareholders since they note that a controlling shareholder does not need to be a majority owner. Given this definition, most listed firms in China are likely to have controlling shareholders.

Although there has been a growing tendency towards managerial ownership in recent years, at the end of 2012, the median value was still extremely low, i.e. 0.00% for SOEs

[53] More specifically, there were: 1. State shares; 2. State owned legal person shares; 3. Promoter legal person shares (domestic); 4. Promoter legal person shares (foreigner); 5. Legal person shares raised; 6. Other non-tradable shares; 7. A-shares (RMB common shares); 8. B-shares (domestically listed common shares quoted in USD or HKD; 9. Foreign shares. Categories 1 to 6 were non-tradable shares. Categories 7 to 9 were tradeable shares.

and 0.01% for Non-SOEs. This result is not unexpected, however, since managers of SOEs are usually government officials appointed by the state and managers of Non-SOEs often have a close relationship with founders. It is well known that large controlling shareholders in Chinese firms can easily fire the manager no matter how many shares the manager owns (Yang et al., 2011). In other words, differently from US firms, the manager-shareholder conflict should not be a prevalent issue in most of the CLFs nowadays (Pistor and Xu, 2005).

Nevertheless, a concentrated ownership plus the split-share structure resulted in very severe agency conflicts between controlling and minority shareholders in the Chinese stock markets. Although governments and legal persons were the large shareholders, they could not directly benefit from stock price appreciations since their shares were non-tradeable and were evaluated by book assets of firms. Therefore, those controlling shareholders had very limited incentives to pursue share value maximization but had high incentives to use their controlling power to practice expropriation at the expense of minority shareholders. During 1996 – 2006, tens of billions of RMB, around 5.4% of total market capitalization, were siphoned from hundreds of firms by controlling shareholders (Jiang et al., 2011). The weak internal and external corporate governances had further aggravated such problems (Jiang and Kim, 2015).

Finally, on April of 2005, the central government initiated the split-share reform aiming to transfer all non-tradeable shares into tradeable shares and to increase market efficiency by reducing political intervention. The reform was implemented quickly. The median percentage of non-tradable shares in the markets was reduced dramatically from 58% in 2005 to just 4.5% at the end of 2012. Many scholars believe that the split-share reform has mitigated the structural problems of CLFs and reduced the controlling-minority shareholder conflicts.[54] Nevertheless, even at the end of 2012, the Chinese governments still maintained strong influence on the markets through controlling around 47% listed firms. Meanwhile, the ownership remains to be concentrated. After a drop in 2006, the median percentages of shares held by the first largest shareholder (35%) and the first five largest shareholders (52%) become relatively stable in the following years.

[54] See, e.g. Jiang et al. (2008); Hou et al. (2012); Yu (2013); Liao et al. (2014).

3.4 Hypotheses

3.4.1 Ownership type and leverage adjustment

A group of studies in financial constraints describe a political pecking order theory, that state-owned enterprises (SOEs) have priority in obtaining bank credits while the firms with other types of ownership, especially privately owned enterprises (POEs), are strongly discriminated against by the official financing channels (Allen et al., 2005 and Cull et al., 2009). The Chinese government has dual roles in corporate financing decisions of SOEs, as it is usually the largest shareholder of SOEs as well as the owner of state owned banks (Li et al., 2009). Nevertheless, this does not necessarily mean that the Chinese governments, especially at the local levels, can have the explicit channels of intervening the lending decisions of state owned banks. Over the past four decades, the banking sector in China has already been transferred from the passive 'policy lending machine' into the biggest financial institution with strong commercial motivations in the financial system (Si, 2015 and Yao and Jiang, 2017). If banks maximize profits, they will tighten credit more vis-a-vis riskier borrowers, such as those with less collateral to pledge and higher monitoring costs (Broner et al., 2014). Comparing with non-state sectors, the remaining SOEs in the economy are much larger in size and tend to have preferential treatment from government policy. Besides, given the relatively weak institutional environment in China, the low transparency of non-state businesses can substantially increase the monitoring costs of banks to lend to POEs. If government ownership can serve as indicators of high creditworthiness or even government guarantees, then lending to SOEs will generate very low monitoring costs for state-owned banks. Moreover, Chinese corporate bond is issued overwhelmingly by the enterprises whose majority shareholder is an organ of the central or local government (Lin and Milhaupt, 2016). This indicates that SOEs often have more alternatives for debt financing than non-SOEs. Lastly, Fan et al. (2013) find that both listed and unlisted SOEs tend to recover much slower than POEs from financial distress and their debt bargaining power towards banks may make the threat of bankruptcy non-credible. All this evidence suggests that SOEs should still have considerably low pressure to eliminate excessive debt, i.e. lower costs of being over-levered, even if their budgets are indeed harder than the pre-reform periods.

According to the above argument, SOEs should face both lower sunk costs of entering the debt market as well as lower variant costs of increasing the amount of borrowing. The low costs of adjustment to the debt part of leverage can allow under-levered SOEs to

increase their leverage ratios more easily towards optimal levels from below. Nevertheless, having low adjustment costs does not necessarily mean that SOEs also have the corresponding incentives to increase their leverage ratios from the positions below through external borrowing. In the trade-off theory, firms should be eager to use interest expenses of debt to shield against income tax, especially when there is substantial debt capacity or large positive cash flow shock. Nevertheless, some empirical evidences about taxation of SOEs suggest that SOEs may not closely follow such value maximizing strategy associated with exploiting tax advantage of debt. For example, Wang et al. (2010) use the implementation of the new Enterprise Income Tax Law 2008 as an experimental lab to study CLFs' debt-related tax shields exploitation as well as capital structure decisions. Their results show that the changes in level of borrowing (whether increases or decreases, in accordance with whether the firms were initially high-taxed or low-taxed), were more pronounced in POEs than in SOEs. Nevertheless, this certainly does not indicate that SOEs nowadays also do not have the corresponding incentives for engaging in tax evasion. In contrast, SOEs, particularly at the central level, constitute by far the most powerful and effective tax lobby and are even able to use their political clout to bargain with the government regarding tax matters[55]. In other words, the tax evasion strategy of Chinese (central) SOEs may put more weights on direct policy exemption rather than the balance sheet (tax-shielding) approaches. Furthermore, several careful studies show that local SOEs in China have significantly higher effective tax rates than central SOEs and non-SOEs[56]. Liu and Li (2012) suggest three reasons why local SOEs are expected to bear higher tax burdens and be less tax sensitive. First, local governments require local SOEs to help them to absorb the costs of fiscal competition. Second, the relatively low level of information asymmetry between local governments and local SOEs makes hiding income to avoid tax become difficult. Lastly, the compensation of local SOE managers may not be tied sufficiently to firm performance and value. Generally, both central and local SOEs in China should be relatively less eager to use interest expenses of debt to shield against income tax, though their motivations behind the seemly coincident choices are likely to be very different. Therefore, taking tax advantages of debt may not be the first priority for SOEs to increase their leverage ratios when under-levered.

[55] For more details about taxation of SOEs, please refer to the comprehensive review by Cui (2015).

[56] The underlying assumption in taxation research at firm-level is that the firms with lower effective tax rates should be more tax sensitive since they are likely to devote more effort to tax reduction (to see, Cao et al., 2009; Liu and Li, 2012)

In contrast, POEs are financially constrained and face much higher costs of defaults than SOEs. When over-levered, POEs can be subjected to stricter lending criteria for nearby future borrowing and easily suffer from potential bankruptcy. Therefore, the costs of being over-levered are higher for POEs than SOEs, indicating that managers of POEs tend to eliminate excessive debt more proactively than do managers of SOEs. Furthermore, when under-levered with sufficient debt capacity, POEs should have higher incentives to borrow more debt and increase leverage ratios more quickly towards the optima. The intuition is quite straightforward. Unlike central SOEs, POEs do not have such power to affect the corporate tax policy. Also, due to the implementation of Company Law in 1994, local governments are no longer having direct methods to squeeze local POEs (compared to local SOEs). Therefore, if taking tax benefits of debt can increase the value of firm (Robinson et al., 2010), then a private shareholder whose interests is closely associated with the value of a controlled firm should have strong incentive to do so. From the perspective of shareholders, the benefits of increasing leverage ratios when under-levered are expected to be higher for POEs than SOEs. Overall, the financing decisions of POEs should be more sensitive to deviations from optimal leverage ratios than those of SOEs. We propose the following hypothesis:

Hypothesis I: *The CLFs with state ownership should present lower adjustment speed of leverage than the firms with private ownership.*

3.4.2 Ownership concentration and leverage adjustment

The monitoring benefits (expropriation risks) brought by a controlling shareholder should be positively (negatively) correlated with the amount of ownership stakes concentrated in his or her hands (La Porta et al., 1999 and Betrand et al., 2002). On the one hand, a controlling shareholder in China's stock market usually owns a substantial proportion of the firm's total shares and has strong incentives to monitor managers and maximize profits (Jiang and Kim, 2015). For instance, Xu and Wang (1999) and Chen et al. (2009) find that the CLFs with more concentrated ownership present better performances. On the other hand, it is also common to see that an ultimate shareholder controls a CLF through a pyramid system but obtains only a small proportion of the firm's cash flow rights, i.e. large excessive control rights. The weak internal and external governance mechanisms provide strong incentives for such a controller to transfer wealth from the downside firm in the pyramid system to the upside firm in which he or she has higher cash flow rights.

Empirical evidence is provided by several studies to show the tunnelling behaviours of controlling shareholders in CLFs, e.g. earnings management (Liu and Lu, 2007); intercorporate loans (Jiang et al., 2010) and connected transactions (Peng et al., 2011).

In the debt market, perceiving the risks of being expropriated, poorly protected creditors may avoid lending to firms with complex ownership structures (La Porta et al., 1997, 2002). Using datasets from East Asia and West Europe, Lin et al. (2011) find that the cost of debt financing, measured by loan spreads, is significantly higher for companies with an ultimate owner having greater excess control rights. As a typical transition economy, China has a capital market with incomplete regulations and weak legal protections for investors. Given the prevalence of the pyramid system, it is also reasonable to infer a negative relation between the costs of debt faced by a firm and the degree of ownership concentrated in the hands of a firm's controlling shareholder. Therefore, a firm with more complex ownership structure, i.e. lower ownership concentration, should face higher costs of leverage adjustment and present lower converging speed towards its target ratios. In contrast, a firm with less complex ownership structure, i.e. higher ownership concentration, is likely to be offered more flexible choices in terms of external borrowing as it is considered a much safer borrower.

Additionally, in China's stock market, a firm with more complex ownership structure should also face higher risk premium in equity issuance since outside equity buyers, especially individual investors, are afraid of being exploited by the firm's controlling shareholder whose interests are not closely bonded with firm performance. If the firm is over-levered, then its manager may not be able to reduce the indebtedness level by easily expanding the firm's equity. Lastly, if the optimal leverage converging behaviour is a sort of value maximizing policy, then the large controlling shareholders with a high level of ownership stakes are more likely to adjust the firm's leverage ratio from deviations towards optimal levels, thereby maximizing their own values. Overall, our arguments suggest that the financing decisions of the firms with more (less) concentrated ownership structure should be more (less) sensitive to deviations from optimal leverage. Therefore, we propose the following hypothesis:

Hypothesis II: *The CLFs with higher (lower) ownership concentration should present higher (lower) adjustment speed of leverage.*

The incentives of controllers are likely to vary between SOEs and POEs. Private large controlling shareholders often nominate themselves or their representatives as the CEO or the Chair and their incomes can be closely tied with firm performance as well as share value appreciation. For SOEs, however, the corporate governance can be characterized as an "agent monitoring agent" mechanism in which the state is the principal and all the provincial and local officials serve as agents of the state. These agents only have control rights but cannot claim residuals, so they may have built-in low incentives to pursue profit maximization. Nevertheless, state controlling shareholders should also have lower incentives to expropriate minority shareholders, since the state is not literally a person who can directly or personally benefit from tunnelling.[57] With poor legal protections to individual investors, however, the unrestricted private controlling shareholders who do not own substantial cash flow rights of the firm are more likely to exploit resources away from the firm (Jiang et al., 2010).

The above arguments suggest that the connection between ownership concentration and leverage adjustment can be more significant in POEs than SOEs. First, if private large shareholders have higher incentives to be involved in firms' value maximizing decisions than state large shareholders, then they should take the systematic deviations from optimal leverage more seriously as these deviations may dampen the value of firms. Second, if private shareholders are believed to have stronger built-in incentives to practice expropriation, then the controlled firms should face higher costs of being excessively levered as well as higher costs of large borrowing. For SOEs, however, the behaviours of their controllers may not exactly follow such a working mechanism. The nominated controllers of SOEs may still lack sufficient motivation to pursue value maximizing policies even if they are designated to manage a large amount share of the controlled firms. Correspondingly, they may also not be able to directly benefit from tunneling behaviours. Even if they show some signs of expropriating, their further borrowings are less likely to be strictly constrained due to the fact that the state has dual roles in corporate financing decisions. Overall, having higher level of ownership stakes should make the benefits of approaching optimal leverage levels larger for the private controlling shareholders than for the state controlling shareholders. Therefore, our last working hypothesis is:

[57] Instead, the state may use SOEs as vehicles to pursue political objectives if necessary. Differently from private shareholders, it is unlikely for state shareholders to practice devastative expropriation from controlled firms.

Hypothesis III: *The positive connection between ownership concentration and leverage adjustment speed should be stronger in POEs than in SOEs.*

3.5 Leverage adjustment speed measurements

3.5.1 Baseline model

Understanding the following structural model of partial adjustment is usually the starting point of estimating the adjustment speed of leverage (e.g. De Miguel and Pindado, 2001; Fama and French, 2002; Kayhan and Titman, 2007):

$$L_{it} - L_{it-1} = \lambda(L_{it}^{*} - L_{it-1}) + \nu_{it} \qquad (3.1)$$

where L_{it} is the actual leverage ratio for firm i at time t and L_{it}^{*} is the optimal/ target leverage ratio suggested by the implication of the trade-off theory. The intuition of equation (3.1) is that changes in actual leverage ratios ($L_{it} - L_{it-1}$) should partially absorb differences between target leverage (L_{it}^{*}) and the actual lagged leverage (L_{it-1}) and hence coefficient λ should measure how quickly the manager can close the gap, i.e. the speed of leverage adjustment. If there are no costs of adjustment, then firms can adjust their leverage ratios instantaneously from deviations, i.e. $\lambda = 1$. Nevertheless, market frictions generate substantial adjustment costs which prevent managers completely rebalancing within a short time period, i.e. $0 < \lambda < 1$. Therefore, a value maximizing firm facing lower costs of adjustment should present a higher value of λ.

One key issue is that the optimal target leverage ratio L_{it}^{*} is a hypothetical level for maximizing value of a firm and it is unobservable to economists. To make equation (3.1) estimable, we can firstly rearrange it as:

$$L_{it} = (1 - \lambda)L_{it-1} + \lambda L_{it}^{*} + \mu_i + \nu_{it}. \qquad (3.2)$$

Then, we can replace L_{it}^{*} as the linear combination of some firm-level (observable) variables which are believed to be related with the costs and benefits of debt financing:

$$L_{it}^{*} = \beta X_{it-1} \qquad (3.3)$$

where X_{it} contains market to book ratio, firm size, profitability, tangibility, non-debt tax shields, median industry leverage, firm-level fixed effects and year dummies. All independent variables are lagged once to avoid direct reversed causality and all variable definitions can be found in Appendix B of this chapter. The conventional literature in trade-off theory can provide justifications for these variables as important determinants of leverage ratios. Specifically, the distress costs and value loss are larger for fast growing firms, so the benefits from tax savings are offset rapidly, leading to lower debt ratios for firms with high growth opportunities (Titman and Wessels, 1988). Larger firms tend to have lower default risks which allow them to gain more debts (Chan et al., 1985). Fixed assets can be used to collateralize and are relatively more immune from serious devaluation, indicating that firms with higher tangibility have lower distress costs and hence higher leverage level. Industry median leverage ratio can reflect a number of omitted common factors across firms within the same industry (Hovakimian et al., 2001). The most controversial issue is probably the relation between profitability and leverage ratio. Comparing to expected bankruptcy costs, in the trade-off theory, benefits from tax shields should be more valuable for firms with high profits. In the agency theory, for firms with high profits but low investment opportunities, debt discipline can reduce the free cash flow problem (Jensen, 1986). Therefore, there should be a positive relation between profitability and leverage ratio. However, the estimated coefficient for profitability in leverage model is usually negative and highly statistically significant, which is often regarded as rejection to the trade-off theory but the most straightforward evidence supporting the pecking order theory (Myers, 1993).[58]

By substituting equation (3.3) into equation (3.2), we can obtain:

$$L_{it} = \gamma L_{it-1} + \theta' X_{it-1} + \nu_{it} \tag{3.4}$$

where $\gamma = (1 - \lambda)$ and $\theta = \lambda\beta$. The larger the value of γ, the smaller the value of λ should be, i.e. lower adjustment speed. Equation (4) is the standard reduced-form partial

[58] In the pecking order theory, firms should prefer internal funds, such as cash flow, to external debts. More discussion about the effects of profitability on firms' market leverage ratio and financing decisions can be found in Hovakimian et al. (2001), Hovakimian et al. (2004) and Welch (2004). This debate is recently reconciled by Danis et al. (2014) who use the dynamic inaction model and find that a positive correlation between profitability and leverage exists when firms are undertaking large leverage restructuring while at other times this relationship is negative. Their results have further strengthened the insignificant positive correlation detected by Korteweg and Strebulaev (2012).

adjustment model proposed by Flannery and Rangan (2006). Ideally, we can also use equation (3.3) to generate the predicted $\widehat{L_{it}}$ which can be used to replace the unobservable L_{it}^{*} in equation (3.1) and then estimate equation (3.1) directly. However, the results obtained by using this method are very likely to suffer from measurement errors to target leverage ratios. Estimating equation (3.4) and calculating the adjustment speed coefficient from γ should largely alleviate this issue. We will return to this problem later in the robustness tests.

3.5.2 Estimations

Three major econometric issues are involved in the estimation procedure of dynamic panel data model (3.4) using financial variables. First, ***endogeneity*** is always problematic in the empirical research of corporate finance. The problem can be generated by the correlation between fixed effects and lagged dependent variable (L_{it-1}) as well as the potential simultaneity between dependent variable and explanatory variables. Second, financial variables are usually very ***persistent*** over time (Lemmon et al., 2008). This can cause high serial correlation in the error terms which violates the assumption of some estimators, such as IV/GMM, used to solve endogeneity issue.[59] Third, some financial variables, such as leverage and debt maturity, are usually treated as ***bounded*** variables distributing within 0 and 1. Since most linear estimators are designed for continuous variables, their properties may be affected if the dependent variable is fractional (Loudermilk, 2007). All these three problems should exist in the estimation of equation (3.4) and can make for some real empirical challenges.

Unfortunately, even nowadays, there is no single general estimation method that can solve all these problems without losing efficiency or relying on very strict statistical assumptions (Dang et al., 2015). Therefore, in this chapter, we will attempt to use different methods to estimate one regression model and solve different issues respectively in each specification and draw conclusions about our research questions based on the shared tendency among different estimators. To begin with, the correlation between fixed effects and lagged leverage ratio should result in upward biased OLS estimator for the coefficient γ, i.e. lower than actual adjustment speed $\lambda = (1 - \gamma)$ (Baltagi, 2008). On the opposite

[59] Another problem is lack of theoretical guidance. Different from economic regression model, the corporate finance models are usually intuitive ones and are more likely to suffer from measurement errors and misspecification (Welch, 2011 and Roberts and Whited, 2011).

side, although the Fixed Effects (FE) estimator can eliminate unobservable time invariant effects by using within transformation of variables, it should provide lower biased estimation of the coefficient γ and hence higher than actual value of λ, due to finite-sample (short panel/ limited time periods per firm) bias (Nickell, 1981). To deal with the problem of FE estimator, we can firstly remove the unobservable fixed effects via the first-difference transformation of equation (3.4):

$$\Delta L_{it} = \gamma \Delta L_{it-1} + \theta' \Delta X_{it-1} + \Delta \nu_{it} \quad (3.5)$$

and use L_{it-2} as instruments for ΔL_{it-1} (Anderson and Hisao, 1981). The main limitation of this instrumental variable (IVS) approach is its low efficiency. Therefore, researchers usually prefer to employ the generalized method of moments (GMM) and use longer lagged dependent variables as additional instruments. Arellano and Bond (1991) propose the first-difference GMM estimator (FD-GMM), which considers moment conditions, $E[L_{it-s}\Delta\nu_{it}] = 0$, with t = 3,…,T and s = 2,…,t-1, and uses a vector $(L_{i1}, \dots, L_{it-2})$ as the GMM instrument set for ΔL_{it-1} in equation (9). Blundell and Bond (1998) further develop the system GMM estimator (SYS-GMM) which improves the efficiency of FD-GMM by utilizing additional moment conditions in the level equation (3.4). This estimator considers $(\Delta L_{i2}, \dots, \Delta L_{it-1})$ as instruments for L_{it-1} under the following moment conditions: $E[\Delta L_{it-s}\nu_{it}] = 0$ for t = 3,…,T, and s = 1,…,t-1. The GMM estimator requires no second order serial correlation as well as valid instruments to be chosen. These conditions can be evaluated by using the AR(2) and Sargan/ Hansen tests. There are two major problems of the GMM framework. First, its properties hold when the number of firms is large enough, otherwise the results can be severely biased and imprecise. Second, estimation results are very sensitive to the chosen instrument sets. The Sargan/ Hansen test is very fragile and presents low statistical power in the dynamic panel data leverage model (Dang et al., 2015).

A group of bias-corrected estimators can also be used to address the econometric issues in equation (3.4). One possible solution to unobservable fixed effects is adding one dummy variable for each firm into equation (3.4), which is called the least-squares dummy variable (LSDV) approach. Nevertheless, given finite T (e.g. the average number of years for each firm), the LSDV estimator is inconsistent (Nickell, 1981). Kiviet (1995) develops a bias-corrected least-squares dummy variable (LSDVC) estimator which corrects FE estimator bias analytically. This LSDVC estimator has been extended to cases with unbalanced panels and heteroscedasticity (Kiviet, 1999; Bun and Kiviet, 2003; Bun and Carree, 2006).

In Monte Carlo analysis, Bruno (2005) finds that LSDVC outperforms all kinds of GMM estimators with finite sample. However, there are still two major limitations of the LSDVC estimator. First, it requires non-trivial matrix manipulations in the bias-correction procedure, which can result in extremely high computational burden for a large, or even modest dataset.[60] Second, it relies on a strong assumption that the true model is an AR (1) model. An alternative approach to LSDVC is developed by Everaer and Pozzi (2007) and is named a bias-corrected FE estimator (BC). Instead of relying on complex analytical correction, a BC estimator is based on an iterative bootstrap that simulates the distribution of the FE estimator using the original (biased) FE estimates. This method then corrects the bias iteratively until unbiased estimates of the true parameters are found. The BC estimator has three advantages. First, it does not require instrument settings. Second, the non-parametric bootstrapping does not rely on restrictive parametric distributional assumptions. Besides, the BC estimator is much less computationally demanding than LSDVC. Although both LSDVC and BC have the advantage that they can correct a finite sample bias efficiently, they still cannot provide valid inferences for the estimates when there is potential simultaneity between the dependent variable and the explanatory variables.

According to the argument in Elsas and Florysiak (2015), all the above mentioned estimators ignore the effects from the fractional dependent variable (i.e. the leverage ratio is bounded between 0 and 1) and consequently get biased results. To solve this problem, Elsas and Florysiak propose a DPF estimator which generates an unbiased and consistent adjustment coefficient in the context of unbalanced panel data. More specifically, the DPF estimator is a doubly censored Tobit estimator, relying on a latent variable approach to account for the fractional nature of the dependent variable.[61] It is fundamentally based on the random effects model but it also allows for endogeneity between explanatory variables and the fixed effect and the initial value effect of the dependent variable. The DPF estimator defines unobservable fixed effects in equation (3.4) as:

$$\mu_i = b_0 + b_1 L_{i0} + b_2 \bar{X}_i + b_i \tag{3.6}$$

where L_{i0} is the initial leverage ratio for each firm, $\bar{X}_i$ is the sample average of the explanatory variables presented in equation (3.1) for each firm, $b_i|(X_{it}, L_{i0}) \sim N(0, \sigma_b^2)$ is a

[60] Given just 800 firms, a computer with i3 core and 16GB memory takes more than 40 minutes to run equation (3.4) by using LSDVC in Stata 13.

[61] The DPF estimator is a kind of maximum likelihood estimator. We use the Stata package 'xttobit' to directly implement such estimation strategy.

random firm-level effect capturing additional individual effects outside the information set of L_{i0} and $\bar{X}_i$. One potential weakness of the DPF estimator is that equation (3.6) may not completely model the time variant/ invariant individual effects. The full specification is written as:

$$L_{i,t} = \gamma L_{i,t-1} + \theta' X_{i,t-1} + b_0 + b_1 L_{i,0} + b_2 \bar{X}_i + b_i + u_{i,t}. \quad (3.7)$$

Lastly, another common limitation of OLS, FE, LSDVC, BC and DPF estimators is that they all require the independent variables to be strictly exogenous. Although these estimators can control the correlation between explanatory variables and unobservable fixed effects, they are unable to solve the potential long feedback from dependent leverage to explanatory variables. In other words, most explanatory variables may still be modestly endogenous even after eliminating fixed effects and being lagged once. If this is the case, then GMM estimators are more favourable since they can treat all right hand side variables as endogenous.

Flannery and Hankins (2013) and Dang et al. (2015) explicitly evaluate the performances of all the above mentioned estimators in the applications of the partial leverage adjustment model (3.4). Flannery and Hankins (2013) recommend System GMM and LSDVC as the most appropriate estimators. Nevertheless, under a more rigorous simulation design, Dang et al. (2015) show that the IV/ GMM estimators are very sensitive to control parameters used for the data generating process. For instance, the larger the impact from fixed effects is, the higher the bias of System GMM estimator may be. Dang et al. also find that the DPF estimator does not necessary outperform the LSDVC and BC estimators when the percentage of censoring is high. They conclude that the BC estimator seems to be the most stable one across different simulation environments. Overall, there is no unique estimator which can be applied to the dynamic panel data model given very general settings. Therefore, we do not stick to a single estimator in this study. Rather we use several different estimators such as FD/ SYS-GMM, LSDVC, BC and DPF and attempt to detect a common feature from the results provided by these estimators.

3.6 Data

In this paper, we use the annual firm-level dataset drawn from the China Stock Market & Accounting Research (CSMAR) database from 1998 – 2010, covering all active firms listed in the Shanghai and Shenzhen Stock Exchanges. We use the following methods to clean the original dataset. First, financial firms and utility firms are excluded. Second, the firm-year observations with leverage ratios smaller than zero or larger than one are excluded. Third, the firm-year observations with missing values for used variables are eliminated. The firms with less than 3 consecutive year observations are also dropped. Lastly, the independent variables, included in equation (3.3), are winsorized at 1^{th} and 99^{th} percentiles. The final sample contains 1,490 firms with 14,779 firm-year observations and it is unbalanced. The minimum number of years per firm is 3, the maximum is 13, and the median is 12.

There are several reasons for us to rely on the sample period until 2010. At the end of 2008, the Chinese central government released an unprecedented 4 trillion RMB fiscal stimulus valid in 2009 and 2010. Although it helped bolster that slumping Chinese economy after the financial crisis, it caused some unintended consequences, e.g. explosive increasing in corporate debt to GDP ratio; expansion of shadow banking and further credit misallocation (Bai et al., 2016). These problems resulted in high level of uncertainty in the economy after 2010. Besides, the large investment expenditures stimulated by the fiscal plan are likely to be redundant and may seriously drag down the efficiency of firms' financial decisions in the following years. Inappropriate treatment to such radical changes can result in misleading conclusion about the ownership effects on firms' optimal leverage converging behaviours. In contrast, between 2000 – 2008, the economic growth was remarkably rapid. The non-tradeable share reform in China's stock market was also promoted around 2005 and obtained significant progress at the end of 2010. The promising economy and the successful progress of marketization together create a relatively stable outside environment for firms, which can be regarded as a good experimental lab for researchers to understand the common incentives of controllers to adjust firms' capital structures. Therefore, in this chapter, we put more weights on the sample period ended at year 2010. In Chapter 4, we will further extend the sample period to year 2016 and explicitly explore the impact from the stimulus plan on firms' capital structure decisions.

3.6.1 Ownership definitions

According to our hypotheses presented in section 3.4, we have to measure a firm's ownership type as well as the degree of its ownership concertation. To define a firm's ownership type, many previous studies group the types of shares, e.g. state shares; legal person shares and individual shares (Sun and Tong, 2003 and Wei et al., 2005). Nevertheless, this method is too simplistic and ignores institutional realities (Green, 2004). For instance, legal person shares can be owned by either SOEs or pure POEs. These entities have completely different objectives and incentives and hence using the major proportion of share type to define ownership type can generate misleading results (Chen et al., 2009).

In this paper, therefore, we choose to use the nature of a firm's ultimate owner as proxy for its ownership type, i.e. who actually owns the shares.[62] More specifically, if a firm-year observation shows that the nature of its ultimate controller is the state, then the firm at this year is regarded as an SOE. Although this variable is time invariant for most firms in our dataset, there are still some firms whose ultimate shareholders have been changed from the state to other types of investors due to continued privatization. To maintain as many firms as possible, we construct a time invariant $State_i$ dummy variable which is equal to one if more than 60% of the observations of a firm present as state or government as its ultimate controller, otherwise the dummy variable is equal to zero.[63] The major reason for us to choose such a time-invariant ownership definition is that we then do sample separation tests. Given the requirements of applied advanced estimators for the dynamic panel data model, within panel continuity over a certain number of periods is essential. In the sample separation tests, we mainly compare SOEs and POEs. If a firm-year observation shows that the nature of its ultimate controller is private investors, then the firm at this year is regarded as a POE. The $Private_i$ indicator is also time-invariant (60% cut off). Lastly, the firms with other kinds of ownership types, e.g. collective and foreign firms, occupy a relatively small proportion of the total sample. More importantly, the incentives of their controlling shareholders are vague and are difficult to conjecture. Therefore, we will not consider their situations in this chapter.

[62] Missing information about firms' ownership type is collected by hand from firms' annual reports.
[63] We have also considered 50% and 70% cut-off and have even eliminated those firms who have changed their ownership types during the sample period. The results are not sensitive to these modifications.

We use the percentage of a firm's total shares held by its largest shareholder to measure ownership concentration. We classify a firm into ' $High\ concentration_i$' or '$Low\ concentration_i$' group if the average percentage of its total shares held by its largest shareholder is above or below the sample average of this percentage for all the firm-year observations.[64] To measure the expropriation incentives, previous literature usually computes a controlling shareholder's cash flow rights as the sum of the products of all the equity stakes along the control chains (La Portal et al., 1999; 2002). Nevertheless, we cannot directly calculate the cash flow rights of ultimate shareholders since we do not have detailed equity chain information in the given dataset. Therefore, in this chapter, we choose to use the cash flow rights held by the firms' largest shareholders to indirectly measure the ownership stakes of their controlling shareholders.

Our choice can be justified as follow. First, in the case of three firms, A, B and C, where A owns 80% of B, B owns 51% of C. In this case, A as the ultimate controlling shareholder controls the target firm C through the intermediate firm B and B is the largest shareholder of C. The indirect cash flow rights of A to C is 40.8% = 80%*51%. If we maintain the direct cash flow rights of A to B at 80%, then increasing (decreasing) the direct cash flow rights of B to C from 51% to 70% (30%) can result in increasing (decreasing) the indirect cash flow rights of A to C from 40.8% to 56% (24%). This indicates that the higher percentage of the target firm's total shares held by its largest shareholder or the intermediate firm in the equity chain, the higher possibility of the ultimate controlling shareholder owning more indirect cash flow rights of the target firm should be, if the stake connection between the ultimate controller and the intermediate firm does not change dramatically in the short-run. Of course, the equity chain can involve more than three firms but the logic is similar. More essentially, for CLFs, the close relationship between cash flow rights of the largest shareholder and size/ risks of expropriations of the controlling shareholder has already been detected by several studies. For example, Liu and Lu (2007) identify a negative relation between earnings management and the largest shareholder's interest in the firm, when the cash flow rights of the largest shareholder reach a certain level. In Jiang et al. (2010), 'other account receivables (OACR)' is used as a vehicle for controlling shareholder tunneling in CLFs and they also detect that the value of OARC decreases with the increase of the percentage of shares held by the largest shareholder. These results therefore indicate that the cash flow rights held by the largest

[64] We have also considered the sample medium cut-off, no significant differences.

shareholders can be a good measurement of the expropriating incentives of the ultimate controlling shareholders of CLFs.

3.6.2 Descriptive statistics

Table 3.1 contains statistical descriptions for most important financial variables. There are several pertinent facts. First, during our sample period, on average, both the book financial leverage (22%) and total liability (48%) of the non-financial, non-utility CLFs do not appear to be higher than those of US firms (24% and 51%).[65] Second, short term debt (16%) and current liability (41%) are much higher than long term debt (5.5%) and long term liability (7%) respectively. Third, almost 62% of firm-year observations present the state as the ultimate controller while merely 24% of firm-year observations present private investors as the ultimate controller. Lastly, the ownership of CLFs is very concentrated. The largest shareholder, on average, owns more than 37% of the firm's total shares which is 29% larger than the average percentage shares held by the second largest shareholder (8.8%). If the second largest shareholder is considered to constrain the behaviours of the largest shareholder, then such monitoring power may be ineffective.

In the left half of Table 3.2, we compare the average leverage ratios as well as the mean values of firm performance measurements across ownership types. First, SOEs have higher financial leverage than POEs, but the difference in average financial leverages between the two groups of firms is statistically weak. More specifically, SOEs have lower short-term debt but higher long-term debt than POEs. In financing constraint literature, these facts are interpreted as the evidence of 'political discrimination' by the state-owned banks that prefer to lend to SOEs. [66] Second, if we use profitability as a performance measurement, then there is no obvious difference between SOEs and POEs. In terms of Tobin's Q, however, POEs (1.86) have strictly higher value than SOEs (1.53). Furthermore, ownership is more concentrated in SOEs since the average percentage of shares owned by the state largest shareholder is 40% while it is 32% for the private largest shareholder.

[65] For US firms' leverage ratios data, see Halov and Heider (2011); Graham and Leary (2011); Danis et al. (2014). Some studies have compared the total liability of Chinese listed firms with the financial leverage of US firms and incorrectly concluded that Chinese listed firms are seriously over-levered, e.g. Jin and Kumbhakar (2015).

[66] For instance, Allen et al. (2005); Ayyagari et al. (2010); Ding et al. (2013), to name but a few

Table 3.1: Descriptive statistics (Full sample)

	Mean	Std.	Min	Median	Max	Obs.
Book leverage	0.221	0.149	0.000	0.212	0.999	14799
Short term debt	0.165	0.131	0.000	0.148	0.999	14799
Long term debt	0.055	0.085	0.000	0.015	0.800	14799
Total liability	0.479	0.183	0.002	0.485	0.998	14611
Current liability	0.409	0.174	0.002	0.402	0.998	14611
Long term liability	0.069	0.091	0.000	0.024	0.800	14611
Profitability	0.070	0.072	-0.339	0.072	0.256	14799
Sales growth	0.125	0.377	-1.331	0.129	1.536	13309
Cash flow	0.020	0.076	-0.213	0.018	0.248	14799
Cash	0.158	0.121	0.000	0.129	1	14799
Tobin Q	1.608	0.878	0.807	1.318	6.041	14799
Investment	0.068	0.077	0.000	0.042	0.394	13309
Size	21.250	1.047	18.699	21.133	24.433	14799
Age	9.461	4.530	0	9	27	14799
State control	0.618	0.486	0	1	1	14799
Private control	0.241	0.428	0	0	1	14799
Largest shareholder	0.377	0.158	0.035	0.355	0.864	9477
2^{nd} shareholder	0.088	0.080	0.003	0.061	0.440	9477
$2^{nd} – 5^{th}$ shareholders	0.158	0.119	0.011	0.132	0.609	9477

State is a dummy variable equal to one if the firm at that year is ultimately controlled by the state. **Private** is a dummy variable equal to one if the firm at that year is ultimately controlled by the private investor. Definitions of all variables are presented in Appendix B.

In the right half of Table 3.2, we classify a firm into the High (Low) concentration group if its largest shareholder owns the proportion of total shares more (less) than the sample median (36%). In China's stock market, firms having financial or operational problem, i.e. losses in two consecutive years, are marked as the stock with 'Special Treatment (ST)'. A notable fact observed in Table 3.2 is that the CLFs with higher level of ownership concentration present a higher value of profitability but lower value of Tobin's Q. One possible explanation is that the lower concentrated group contains a higher proportion of ST/ distressed firms with values of equity more likely to be twisted by the misbehaviours of investors. Specifically, at the bottom of the table, we also report the percentage of ST/ distressed firms in each category. Outside speculators are eager to exchange ST stocks since they expect that prices will increase dramatically once the firms have recovered from the distress. Unfortunately, less than 5% firms ultimately escaped from ST during our sample period, indicating that ST stocks may often be overvalued. In the group with lower ownership concentration, the percent of ST observations (21%) is much higher than that of the firms in the group with higher ownership concentration (14%). In unreported results, we have also compared the Tobin's Q between two groups without those ST firms and found that the difference indeed becomes much smaller.

Table 3.2: Descriptive statistics (Ownership structures)

	State	Private	Diff	High	Low	Diff
Book leverage	0.222	0.217	0.005*	0.219	0.222	-0.002
Short term debt	0.161	0.172	-0.010***	0.157	0.166	-0.008***
Long term debt	0.060	0.045	0.015***	0.061	0.055	0.006***
Total liability	0.482	0.473	0.009**	0.498	0.500	-0.002
Current liability	0.407	0.413	-0.006*	0.420	0.426	-0.006*
Long term liability	0.069	0.052	0.017***	0.071	0.064	0.007***
Profitability	0.070	0.071	-0.001	0.080	0.062	0.017***
Sales growth	0.129	0.127	0.002	0.174	0.105	0.068***
Cash flow	0.020	0.019	0.001	0.024	0.029	0.006
Cash	0.153	0.172	-0.019***	0.163	0.161	-0.002
Tobin Q	1.536	1.867	-0.331***	1.505	1.949	0.445***
Investment	0.069	0.068	0.001	0.076	0.063	-0.013***
Size	21.355	20.935	0.420***	21.589	21.177	0.412***
Age	9.092	10.341	-1.249***	9.732	11.995	-2.262***
Largest shareholder	0.406	0.322	0.083***	0.508	0.245	0.262***
2^{nd} shareholder	0.079	0.105	-0.025***	0.065	0.112	-0.046***
2^{nd} – 5^{th} shareholders	0.138	0.195	-0.057***	10.860	20.717	-9.857***
Other receivable	0.055	0.063	-0.008***	0.036	0.054	-0.018***
ST stocks (distress)	21.37%	23.78%		14.25%	20.89%	
Firms	1067	614		898	847	
Observations	9672	3570		4814	4815	

State is a dummy variable equal to one if the firm at that year is ultimately controlled by the state. **Private** is a dummy variable equal to one if the firm at that year is ultimately controlled by the private investor. **High** (**Low**) is a dummy variable equal to one if the percentage of a firm's total shares held by its largest shareholder is larger (smaller) than the sample medium. Definitions of all variables are presented in Appendix B.

In Table 3.3, we further classify both SOEs and POEs into High and Low ownership concentration groups. [67] The comparisons show that on average the CLFs with more shares concentrated in the hands of their largest shareholders are likely to be more profitable, to grow faster and invest more but to have lower Tobin's Q and are less likely to be distressed. Additionally, the SOEs in the High concentration group are significantly lower levered than the SOEs in the Low concentration group. In contrast, the more concentrated POEs seem to be higher levered than the lower concentrated POEs. Besides, Jiang et al. (2010) find that 'other account receivables (OACR)' is used as a vehicle for large shareholder tunnelling in CLFs and they detect an almost linear negative relationship between the value of OARC and the cash flow rights of the largest shareholder. This indicates that the controlling shareholder with a higher level of cash flow rights has less incentives to tunnel

[67] We have also checked the industry distribution of the firms in each category and found no systematic pattern of the distribution across categories.

from minority shareholders. Based on this inference, in Tables 3.2 and 3.3, we also compare the average values of OARC across ownership types and structures. Indeed, the results show that the POEs and the firms with lower ownership concentration tend to have higher levels of OARC.

Table 3.3: Descriptive statistics (State and Private)

	State			Private		
	High	Low	Diff	High	Low	Diff
Book leverage	0.221	0.234	-0.013***	0.216	0.208	0.008
Short term debt	0.156	0.168	-0.012***	0.167	0.164	0.002
Long term debt	0.065	0.065	0.000	0.049	0.044	0.005*
Total liability	0.504	0.522	-0.018***	0.477	0.476	-0.000
Current liability	0.421	0.436	-0.015	0.415	0.415	0.000
Long term liability	0.076	0.077	0.001	0.057	0.051	0.005*
Profitability	0.077	0.057	0.020***	0.087	0.068	0.019***
Sales growth	0.167	0.102	0.065***	0.194	0.112	0.081***
Cash flow	0.024	0.041	-0.017	0.020	0.015	0.005
Cash	0.154	0.152	0.002	0.192	0.168	0.024***
Tobin Q	1.458	1.824	-0.366***	1.678	2.132	-0.454***
Investment	0.078	0.065	0.012***	0.079	0.065	0.013***
Size	21.707	21.404	0.303***	21.213	20.885	0.327***
Age	9.832	12.441	-2.609***	9.395	11.421	2.026***
Largest shareholder	0.516	0.250	0.266***	0.482	0.240	0.241***
2^{nd} shareholder	0.060	0.107	-0.046***	0.079	0.119	-0.038***
2^{nd} – 5^{th} shareholders	0.098	0.195	-0.097***	0.142	0.223	-0.081***
Other receivable	0.036	0.048	-0.012***	0.037	0.062	-0.025***
ST	14.54%	21.47%		14.56%	16.78%	
Firms	660	517		261	417	
Observations	3,594	2,547		1047	2048	

State is a dummy variable equal to one if the firm at that year is ultimately controlled by the state. **Private** is a dummy variable equal to one if the firm at that year is ultimately controlled by the private investor. **High** (**Low**) is a dummy variable equal to one if the percentage of a firm's total shares held by its largest shareholder is larger (smaller) than the sample average. ST defines the stocks marked as 'Special Treatment' due to two years consecutive loss in profits. Definitions of all variables are presented in Appendix B.

In summary, a few points are obtained from the descriptive analyses. First, the CLFs with state ownership have higher leverage ratios than the CLFs with private ownership. Nevertheless, it is still unclear whether or not state ownership brings better firm performances. Second, the controlling shareholders with higher level of cash flow rights may prefer to actively monitor their firms and hence there should be a positive relation between ownership concentration and firm performance. Lastly, the tunneling behaviours are more likely to happen in the firms with lower ownership concentration.

3.7 Results

3.7.1 Evolution of capital structure

We begin our empirical analysis by studying the evolution of leverage for our cross-section of firms. Figure 3.1 presents the average leverage ratios of four portfolios in the period from 2000 to 2010. At the end of year 2000, we sort firms into four quartiles (portfolios) according to their leverage ratios, i.e. Very High, High, Medium, and Low. [68] We then calculate the average leverage ratios for the firms in each portfolio in each following year until 2010. The component of each portfolio remains the same, i.e. we only track the firms presenting in 2000.

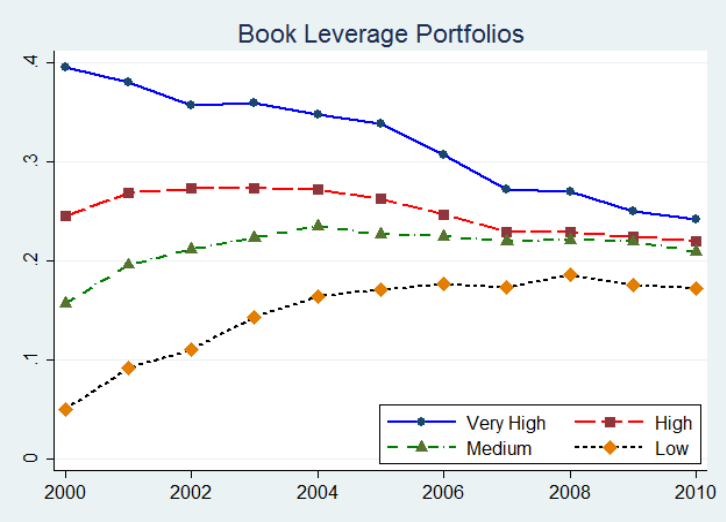

Figure 3.1

Several features are worth mentioning. First, there is a large cross-sectional dispersion in the initial portfolio formation period (ranging from 5% to 40%). Second, all four portfolios present an obvious converging tendency over time. After 10 years, on average, the firms in the Very High book leverage group have reduced their ratios from 40% to 25%. Meanwhile, the firms in the Low portfolio have on average increased their leverage from 5% to 16%. Third, for Medium and Low portfolios, most of the convergences occur within the first 4 years while the Very High and High portfolios tend to converge from higher positions with relatively constant rates. Lastly, even after 10 years convergence, there are

[68] Similar illustrative methods are firstly used by Lemmon et al. (2008).

still significant differences of average leverage ratios across different portfolios, especially between the Very High and Low groups.

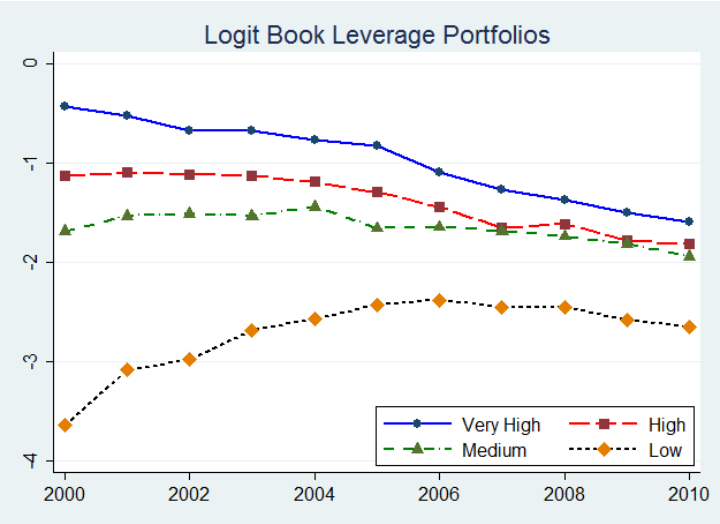

Figure 3.2

One potential concern with interpreting Figure 3.1 is the effect of the bounded support of leverage, i.e. between zero and one. To address this potential weakness, we transferred the leverage ratios into the logit formation and repeat the same procedure in Figure 3.1. [69] The results are presented in Figure 3.2. Two changes can be observed. First, the Medium portfolio becomes more stable over time. Second, the disparity between the Very High and Low portfolios becomes even larger at the end of the sample period than that presented in Figure 3.1. All this evidence suggests that although the general converging tendency has not been changed dramatically, the potential impact from the bounded dependent variable on leverage adjustment speed estimation should be non-trivial.

A final potential concern is that the tendency in Figure 3.1 simply reflects the heterogeneity of firm-level characteristics. For instance, large firms usually have higher level of leverage ratios. Therefore, we control some firm-level variables which may determine cross-sectional variations in leverage ratios and estimate equation (3.3) by using fixed effects estimators. We then re-group the firms according to the error term (high or low unexpected shocks) and calculate the average leverage ratios in each group. The results are presented in Figure 3.3. There are three notable findings. First, it seems that the (possibly over-levered) firms in the Very high and High portfolios are more reluctant (have difficulty) to reduce their leverage ratios in the first 4 to 5 years. Second, the opposite

[69] Logit(leverage) = ln(leverage/(1-leverage))

situation happens for the Medium and Low portfolios in which firms are more likely to increase their leverage ratios in the first 3 to 4 years. Lastly, even after we have controlled the firm-level characteristics, the striking result is that the Low portfolio consistently maintains very low leverage ratios, around 16%, even at the end of sample period. The gap between the Very high and Low portfolios is very prominent over the whole evolution period. Nevertheless, the general converging tendency again remains.

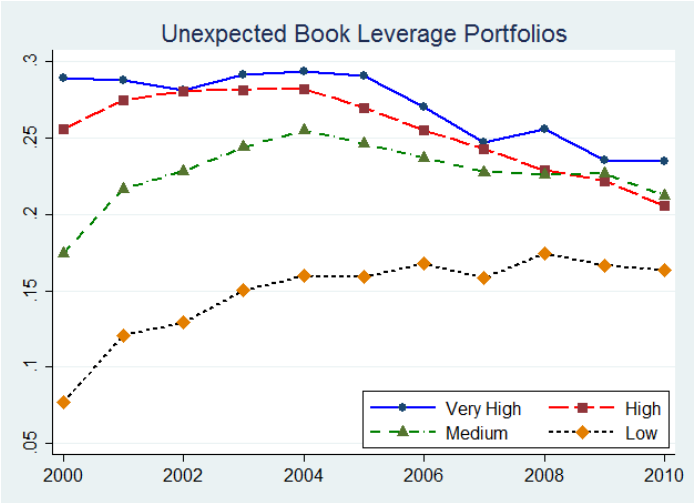

Figure 3.3

In summary, general guidance for our parametric analyses are provided by Figures 3.1-3.3. First, CLFs indeed converge towards more modest levels of leverage from higher and lower positions, though the converging points are not necessarily optimal. Second, even though firms can offset the short-run deviations and move towards target leverage ratio, if there is one, their capital structure decisions are still determined by some unobservable (possible) time-invariant long-run components. Therefore, it may be essential for us to always control fixed effects in our estimations. Lastly, the fractional dependent issue may exist and it requires appropriate handling.

Table 3.4: Baseline adjustment speed

Dependent variable: $Leverage_{it}$	OLS (1)	FE (2)	FDGMM (3)	SYSGMM (4)	LSDVC (5)	BC (6)	DPF (7)
$Leverage_{it-1}$	**0.834*** (0.008)**	**0.530*** (0.013)**	**0.694*** (0.039)**	**0.751*** (0.024)**	**0.713*** (0.014)**	**0.708*** (0.008)**	**0.762*** (0.012)**
$Market\ to\ Book_{it-1}$	-0.007*** (0.001)	-0.004** (0.002)	0.003 (0.005)	-0.004** (0.002)	-0.005** (0.002)	-0.004*** (0.001)	-0.008*** (0.001)
$Size_{it-1}$	0.002*** (0.000)	0.026*** (0.003)	0.053*** (0.019)	0.012*** (0.004)	0.019*** (0.002)	0.018*** (0.002)	0.010*** (0.002)
$Profitability_{it-1}$	0.053* (0.019)	-0.018 (0.019)	0.198** (0.094)	0.110** (0.046)	-0.003 (0.021)	0.008 (0.013)	0.087*** (0.015)
$Tangibility_{it-1}$	0.036*** (0.007)	0.027** (0.011)	-0.044 (0.031)	0.015 (0.016)	0.013* (0.007)	0.012 (0.009)	-0.003 (0.010)
$Nondebt\ tax\ shields_{it-1}$	-0.532*** (0.087)	-0.472*** (0.122)	-0.807*** (0.248)	-0.700*** (0.156)	-0.362*** (0.100)	-0.537*** (0.107)	-0.606*** (0.112)
$Industry\ medianlever_{it-1}$	0.040*** (0.007)	0.238*** (0.029)	-0.052 (0.106)	0.202*** (0.039)	0.217*** (0.021)	0.178*** (0.022)	0.120*** (0.023)
R-squared	68.37%	36.19%					38.77%
AR(2)			0.708	0.969			
Hansen test			0.258	0.416			
Firms		1490	1490	1490		1490	1490
N	13309	13309	11819	13309	13309	13309	13309

This table presents the results for equation (3.4) by using the full sample size. All DPF results are generated by using equation (3.7) in this Chapter. In GMM estimators, all independent variables are treated as **endogenous** and their **second** and **longer** lags are used as instruments. In LSDVC approach, 2SLS estimators are used as the initial values of coefficients and 10 iterations have been set to obtain variance-covariance matrix. In BC approach, FE estimators are used as the initial values of coefficients and the max number of iterations and bootstrapping in each iteration have been set to 50 and 1000 respectively. All standard errors are robust in brackets. P-values of AR (2) and Hansen tests are reported for GMM estimators. R-squared in column (2) for FE is within R-squared. R-squared in column (7) for DPF is pseudo-R-squared. Year dummies are included in all specifications. *, ** and *** correspond to P-values at 10%, 5% and 1% respectively.

3.7.2 Baseline adjustment speed

In Table 3.4, we report the results of equation (3.4) generated by using seven different estimators. Leverage ratio is expressed as financial debt to total assets. In terms of the coefficient on the lagged dependent variable in the dynamic panel data model, the correlation between lagged leverage ratio and unobservable time invariant effects will generate upward biased an OLS estimator but downward biased FE estimator, i.e. the endogeneity issue, so previous literature usually uses these two estimators as the upper and lower boundaries for the coefficient γ. All other reasonable estimators suffering less from this issue should generate a value of γ which lies between that of OLS and FE estimators.

In column (1) of Table 3.4, the OLS estimator presents a coefficient on lagged leverage ratio at 0.83, indicating that the speed of leverage adjustment (SOLA) is equal to $\lambda = (1-\gamma) = (1-0.83) = 0.17$. In column (2), the FE estimator for γ is equal to 0.53 and the corresponding SOLA is 0.47. The dramatic difference between the OLS and FE coefficients reflects the large impact from unobservable time invariant effects on the estimated SOLA, i.e. the severity of endogeneity issue. In columns (3) and (4), the results generated by FD-GMM and SYS-GMM estimators are reported. We treat all explanatory variables in equation (3.4) as endogenous ones, thereby controlling the possible reversed causality. The coefficient on the lagged leverage in FD-GMM (SYS-GMM) is 0.69 (0.75) and the corresponding SOLA is 0.31 (0.25). The p-values from AR (2) and Hansen tests are both large, indicating the validity of the chosen instrument sets and the correct specification of the model. Also, two GMM coefficients indeed lie between the OLS and FE coefficients. Nevertheless, Flannery and Hankins (2013) emphasise that the FD-GMM estimator still tends to generate a downward biased coefficient on the lagged leverage ratio. Dang et al. (2015) argue that the system GMM estimator is more likely to be upward biased. Therefore, in columns (5) and (6), we report the results from two bias correction estimators, i.e. LSDVC and BC estimators. The LSDVC (BC) estimator provides a value of γ equal to 0.71 (0.70) and the corresponding SOLA is 0.29 (0.30). Besides, in column (7), the DPF estimator is used to solve the fractional dependent variable issue, which generates $\gamma = 0.76$ and SOLA = 0.24.[70]

[70] Our results show that for CLFs' dataset, the fractional dependent variable issue may not be as serious as that met by Elsas and Florysiak (2015) when using the US firms dataset.

3.7.3 State ownership effects

In this chapter, we perform the sample separation tests by estimating equation (3.4) respectively using the data of the firms classified into different ownership categories. The main assumption behind this method is that the costs and benefits of debt should differ across firms with different ownership structures. Both the target leverage ratio and the path to the optimal are heterogeneous for the firms in different ownership categories.

We firstly classify all firms into two categories according to their ownership types, i.e. 'State' and 'Private', and estimate equation (3.4) for the firms in each group. If our **Hypothesis I** is correct, the $\gamma_{SOE} > \gamma_{POE}$, i.e. $\{\lambda_{SOE} = (1 - \gamma_{SOE})\} < \{\lambda_{POE} = (1 - \gamma_{POE})\}$, where λ_{SOE} and λ_{POE} are the adjustment speed coefficients for SOEs and POEs, respectively.

The results are reported in Panel A of Table 3.5. We use system GMM, LSDVC and DPF estimators, since they provide relatively reasonable estimation results in Table 3.4.[71] According to the SYS-GMM results, in columns (1) and (2), there is a slight declining tendency of the coefficient on lagged leverage ratio from SOEs (77%) to POEs (72%). Nevertheless, for LSDVC and DPF estimators, in columns (3) and (4), POEs do not appear to adjust their leverage faster than SOEs. One potential issue is that the estimation results in Panel A are affected by the uneven distribution of ST/ distressed firms across ownership types.[72] Therefore, we simply eliminate the firms that have been marked as 'ST stock' at least once during the sample period and repeat the sample separation tests. The results are reported in Panel B of Table 3.5. For the SYS-GMM estimator, in columns (1) and (2), the coefficient γ on lagged leverage ratio obviously decreases from the SOEs (γ = 75%, SOLA = 25%) to the POEs (γ = 63%, SOLA = 37%). In columns (5) and (6), the DPF estimator presents a similar tendency, i.e. SOEs (γ = 80%, SOLA = 20%) and POEs (γ = 63%, SOLA = 37%). Although the LSDVC estimator, in columns (3) and (4), does not generate a difference as large as that of the SYS-GMM and DPF estimators, the declining tendency of the coefficient γ from SOEs to POEs still exists. Consequently, after we have controlled the effects of ST/ distressed firms across the ownership types, we are able to conclude that

[71] The first-differenced GMM estimator is smaller than all other advanced estimators and it also reduces our sample size. The BC estimator cannot converge in some of our sample separation tests due to the small sample issue.
[72] See Tables 3.2&3.3 for more details.

SOEs tend to adjust their leverage ratios towards optimal levels at a slower speed than POEs, which supports our **Hypothesis I**.

Table 3.5: Ownership types and leverage adjustment

Panel A. Ownership types

	SYS-GMM		LSDVC		DPF	
Dependent: $Leverage_{it}$	State (1)	Private (2)	State (3)	Private (4)	State (5)	Private (6)
$Leverage_{it-1}$	**0.773*** (0.029)**	**0.719*** (0.048)**	**0.711*** (0.009)**	**0.727*** (0.018)**	**0.764*** (0.015)**	**0.778*** (0.024)**
R-squared					39.07%	40.42%
AR(2)	0.649	0.433				
Hansen test	0.207	0.205				
Firms	884	458	884	458	884	458
N	8632	3322	8632	3322	8632	3322

Panel B. Ownership types (exclude ST firms)

Dependent: $Leverage_{it}$	State (1)	Private (2)	State (3)	Private (4)	State (5)	Private (6)
$Leverage_{it-1}$	**0.753*** (0.033)**	**0.630*** (0.039)**	**0.705*** (0.014)**	**0.662*** (0.031)**	**0.806*** (0.020)**	**0.630*** (0.039)**
R-squared					35.52%	29.69%
AR(2)	0.745	0.378				
Hansen test	0.104	0.630				
Firms	652	345	652	345	652	345
N	6290	2174	6290	2174	6290	2174

This table contains the results from sample separation tests by using equation (3.4). Variable definitions are presented in Appendix B. In this Table, only the coefficient on lagged leverage ratio is reported for brevity. The full version of this table is represented in Table B.11 in Appendix B. All standard errors are robust in brackets. P-values of AR (2) and Hansen tests are reported for GMM estimators. Year dummies are included in all specifications. Econometric specification is similar with the information presented at the bottom of Table 3.4. *, ** and *** correspond to P-values at 10%, 5% and 1% respectively.

3.7.4 Ownership concentration effects

Tables 3.6 and 3.7 report the results of the effects of ownership concentration on the leverage adjustment behaviours of SOEs and POEs, respectively. Since the ownership concentration information is only available from 2003 and after, we have excluded the firm-year observations before 2003. All the remaining firms are classified into the 'Low' or 'High' ownership concentration group. If **Hypothesis II** is correct, then $\gamma_{LOW} > \gamma_{HIGH}$ since we expect that $(\lambda_{LOW} = 1 - \gamma_{LoW}) < (\lambda_{HIGH} = 1 - \gamma_{HIGH})$ where λ_{LOW} and λ_{HIGH} are the adjustment speed for the firms with low and high ownership concentrations respectively.

Table 3.6: Ownership concentration and leverage adjustment (SOEs)

Panel A. State Firms

	SYS-GMM		LSDVC		DPF	
Dependent: $Leverage_{it}$	Low (1)	High (2)	Low (3)	High (4)	Low (5)	High (6)
$Leverage_{it-1}$	**0.723*** (0.058)**	**0.706*** (0.040)**	**0.696*** (0.030)**	**0.694*** (0.025)**	**0.827*** (0.025)**	**0.791*** (0.025)**
R-squared					0.502	0.368
AR(2)	0.570	0.536				
Hansen test	0.587	0.128				
Firms	365	495			365	495
N	2377	3132	2377	3132	2685	3530

Panel B. State Firms (Exclude ST firms)

Dependent: $Leverage_{it}$	Low (1)	High (2)	Low (3)	High (4)	Low (5)	High (6)
$Leverage_{it-1}$	**0.827*** (0.079)**	**0.778*** (0.043)**	**0.730*** (0.032)**	**0.647*** (0.038)**	**0.861*** (0.016)**	**0.796*** (0.031)**
R-squared					0.419	0.328
AR(2)	0.666	0.727				
Hansen test	0.149	0.210				
Firms	262	390			262	390
N	1696	2458	1696	2458	1909	2755

This table contains the results from sample separation tests by using equation (3.4). The data of SOEs is used. **High** (**Low**) is a dummy variable equal to one if the average percentage of a firm's total shares held by its largest shareholder is larger (smaller) than the sample average. In this Table, only the coefficient on lagged leverage ratio is reported for brevity. The full version of this table is represented in Table B.12 in Appendix B. All standard errors are robust in brackets. P-values of AR (2) and Hansen tests are reported for GMM estimators. Year dummies are included in all specifications. Econometric specification is similar with the information presented at the bottom of Table 3.4. *, ** and *** correspond to P-values at 10%, 5% and 1% respectively.

In Table 3.6, Panel A reports the results for SOEs. According to the SYS-GMM and DPF results, in columns (1), (2), (5) and (6), the coefficient γ of the low concentration group is slightly larger than that of the high concentration group. For LSDVC estimator, in columns (3) and (4), such slight difference almost disappears. Our **Hypothesis II** is not strongly supported for SOEs at this stage. Again, to control the possible effects from the ST/ distressed firms, we exclude all ST firms and repeat the above estimation process. The results are reported in Panel B of Table 3.6. From column (1) to column (6), all three estimators convey very similar information: that the SOEs with lower ownership concentration tend to adjust their leverage ratios towards optimal levels at a slightly slower pace than the SOEs with higher ownership concentration. The difference of calculated SOLA between the low and high concentration groups varies from 5% in the SYS-GMM estimator to 10% in the LSDVC estimator. Therefore, after we have controlled the effects of the ST/ distressed firms, we can conclude that the SOEs with high ownership

concentration tend to adjust their leverage ratios to the target levels at a faster speed than the SOEs with low ownership concentration, which supports our **Hypothesis II.**

Table 3.7: Ownership concentration and leverage adjustment (POEs)

Panel A. Private Firms

	System GMM		LSDVC		DPF	
Dependent: $Leverage_{it}$	Low (1)	High (2)	Low (3)	High (4)	Low (5)	High (6)
$Leverage_{it-1}$	**0.776*** (0.101)**	**0.513*** (0.112)**	**0.639*** (0.031)**	**0.526*** (0.051)**	**0.788*** (0.034)**	**0.699*** (0.058)**
R-squared					0.398	0.217
AR(2)	0.282	0.166				
Hansen test	0.423	0.209				
Firms	266	178			266	178
N	1512	856	1512	856	1661	925

Panel B. Private Firms (Exclude ST firms)

Dependent: $Leverage_{it}$	Low (1)	High (2)	Low (3)	High (4)	Low (5)	High (6)
$Leverage_{it-1}$	**0.753*** (0.097)**	**0.415*** (0.109)**	**0.628*** (0.042)**	**0.460*** (0.069)**	**0.773*** (0.048)**	**0.579*** (0.059)**
R-squared					0.291	0.146
AR(2)	0.652	0.242				
Hansen test	0.485	0.386				
Firms	193	152			193	152
N	1025	690	1025	690	1103	737

This table contains the results from sample separation tests by using equation (3.4) and POEs. **High** (**Low**) is a dummy variable equal to one if the average percentage of a firm's total shares held by its largest shareholder is larger (smaller) than the sample average. In this Table, only the coefficient on lagged leverage ratio is reported for brevity. The full version of this table is represented in Table B.13 in Appendix B. All standard errors are robust in brackets. P-values of AR (2) and Hansen tests are reported for GMM estimators. Year dummies are included in all specifications. Econometric specification is similar with the information presented at the bottom of Table 3.4. *, ** and *** correspond to P-values at 10%, 5% and 1% respectively.

Table 3.7 reports the effects of ownership concentration on the leverage adjustment behaviours of POEs. In panel A, all three estimators tell the same story: that the POEs with higher ownership concentration have higher SOLA than the POEs with lower ownership concentration. The difference in the calculated SOLAs between the high and low concentration groups varies from 10% in the DPF estimator to 26% in the System estimator. In Panel B, we again exclude all the ST firms. For the POEs in the high concentration group, the value of coefficient for lagged leverage ratio has not changed significantly. However, for the POEs with High ownership concentration, the coefficient has further reduced. This obviously increases the gap of the SOLA between the two groups of firms. For instance, in columns (1) and (2), the SYS-GMM estimator indicates that the SOLA for the high concentration group is 59% = (1-0.41) while the SOLA for the low

concentration group is just around 25% = (1-0.75). Therefore, the marginal impact from ownership concentration on the leverage adjustment behaviour is much larger in POEs than in SOEs. This is consistent with the prediction in **Hypothesis III**.

There are several implications from our empirical results. First, the inefficiency of SOEs can be reflected by their relatively lower estimated leverage adjustment speed towards the optimal ratio than that of their private counterparts who are believed to be much more efficient. This low efficiency of SOEs is probably caused by the soft budget constraint as well as their lower incentives to take the tax advantages of debt. Second, in an immature capital market with poor legal protections of creditors, such as that of China, the risks of being expropriated by the controlling shareholders with low cash rights of the controlled firms can increase the costs of leverage adjustment which can prevent the firms from pursing their optimal leverage levels. This highlights the importance for information disclosure about shareholders' behaviours. Lastly, including ST/ distressed firms in the capital structure analyses using CLFs' dataset may generate misleading results as those firms, most of the time, will become 'shell' companies which do not behave normally in both product and capital markets. Further research in this field should pay higher attention to such potential issues.

3.8 Robustness tests

3.8.1 Two-step approach

Except for the one-step reduced form approach, i.e. equation (3.4), used to generate our major results, the literature also applies the following two-step approach (e.g. De Miguel and Pindado, 2001; Fama and French, 2002; Kayhan and Titman, 2007; Faulkender et al., 2012). Firstly, we can estimate equation (3.3) and then use the estimated coefficients to predict the leverage ratio for each firm-year observation. The predicted leverage can be regarded as an optimal one. In the second stage, we can obtain the adjustment coefficient λ directly by estimating equation (3.1) once L_{it}^{*} is replaced by the predicted leverage. If we assume that costs and benefits of adjustment can vary across firms with and without state ownership, then we can simply parametrise λ in equation (3.1) as a linear function of state ownership:

$$\lambda = \alpha_0 + \alpha_1 State_{it} \tag{3.8}$$

where $State_{it}$ is time-variant indicator to the presence of state ownership; the coefficient α_1 measures the direct effects from state ownership on firms' adjustment speed and the coefficient α_0 is the homogenous adjustment speed for all other firms in the absence of $State_{it}$. Therefore, the adjustment speed specific to SOEs can be calculated as $(\alpha_0 + \alpha_1)$. Then, we can substitute equation (3.8) into equation (3.1):

$$L_{it} - L_{it-1} = (\alpha_0 + \alpha_1 State_{it}) * \left(\hat{L}_{it} - L_{it-1}\right) + \nu_{it} \tag{3.9}$$

$$Change_{it} = \alpha_0 DEV_{it} + \alpha_1 State_{it} * DEV_{it} + \nu_{it} \tag{3.10}$$

where $\hat{L}_{it}$ is the predicted leverage ratio; $Change_{it} = (L_{it} - L_{it-1})$; $DEV_{it} = \left(\hat{L}_{it} - L_{it-1}\right)$. If the implication of our **Hypothesis I** is correct, then we shall see that α_1 is negative and statistically significant. Similarly, we can replace $State_{it}$ in equations (3.8) and (3.9) with the indicator measuring the degree of ownership concentration and rewrite equation (3.10) as:

$$Change_{it} = b_0 DEV_{it} + b_1 High\ concentration_{it} * DEV_{it} + \omega_{it} \tag{3.11}$$

where $High\ concentration_{it}$ is a time-variant dummy variable equal to one if firm i at time t has a level of ownership concentration higher than the sample average level of ownership concentration, otherwise it is equal to zero. In equation (3.11), b_1 can measure the direct effects from the ownership concentration level on firm's adjustment speed and $(b_0 + b_1)$ can be treated as the adjustment speed specific to the firm with higher than average level of ownership concentration. If the implication of our **Hypothesis II** is correct, then we shall see that b_1 is positive and statistically significant. More importantly, in the sample separation tests, we use the time-invariant ownership indicators. Although such treatment can help us to keep more observations and perform advanced estimators with relatively stable sample composition, it inevitably eliminates some potential effects from ownership transitions. Lastly, we exclude all firms that present at least one ST firm-year observation.

Table 3.8: Two-step approach

Dependent: $Change_{it}$	Full sample (1)	State (2)	Private (3)
DEV_{it}	0.281***	0.157***	0.343***
	(0.033)	(0.036)	(0.069)
$State_{it} * DEV_{it}$	-0.102***		
	(0.043)		
$High_{it} * DEV_{it}$		0.138***	0.228***
		(0.046)	(0.091)
Constant	0.006**	0.018***	0.013**
	(0.003)	(0.004)	(0.005)
Year Dummy	Y	Y	Y
AR(2)	0.904	0.480	0.841
Hansen test	0.463	0.136	0.699
Firms	1165	648	371
Observations	9789	4125	2105

This table contains the results for equations (3.10)&(3.11). System GMM results are presented. Twice and more lagged independent variables are used as instruments. $Change_{it}$: $\hat{L}_{it} - L_{it-1}$; $DEV_{it} = \hat{L}_{it} - L_{it-1}$; $State_{it}$: in column (1), it is a time variant dummy variable. In columns (2) & (3), both state and private dummy variables are time invariant. $High_{it}$: is a time variant high ownership concentration dummy variable. The target leverage ratio $\hat{L}_{it}$ is predicted by using the fixed effects coefficients from equation (3.3). Largest shareholder information is only available from 2003 and after. Therefore, target leverage ratios are re-estimated by using reduced sample size in columns (2) & (3). More specific definitions of all variables are presented in Appendix B. All standard errors are robust in brackets. P-values of AR (2) and Hansen tests are reported. Year dummies are included in all specifications. *, ** and *** correspond to P-values at 10%, 5% and 1% respectively.

The System GMM results are reported in Table 3.8.[73] Column (1) contains the results for equation (3.10). The coefficient α_0 is equal to 0.28 which is very close to the calculated adjustment coefficient from our one-step approach (see Table 3.4). The coefficient for the interaction term between state ownership indicator and deviation from target leverage ratio is negative and highly statistically significant, which is very consistent with our **Hypothesis I**. Columns (2) and (3) contain the results for equation (3.11) using the dataset

[73] It is still unclear whether or not there is a fixed effect which can determine firms' adjustment coefficient in the second stage estimation, e.g. equations (3.10) & (3.11). One group of scholars believe that there are no fixed effects in equation (3.1) and they simply use OLS estimator with bootstrapped standard errors to solve the generated regressor problem (Oztekin and Flannery, 2012 and Faulkender et al., 2012). Nevertheless, Dang, (2013) and Dang et al. (2015) emphasize that the correlation between L_{it-1} and v_{it} may still behave as a time invariant effect which may bias adjustment coefficient estimation. Another unproved potential problem is that the systematic measurement error in predicted target leverage inherited from the first-stage estimation may act as a time-invariant effect in the second-stage estimation. Therefore, in unreported results, we have firstly used OLS and Fixed effects estimators to estimate both equations (3.10) & (3.11) and found a dramatic difference between the two groups of coefficients. This indicates that there should be unobservable fixed effects affecting the value of estimated adjustment speed. Considering the inconsistency of OLS and Fixed effects estimators in estimating dynamic panel data model, we rely on the GMM estimator.

of SOEs and POEs, respectively. The coefficients for the interaction term between high concentration indicator and deviation term are positive and highly statistically significant for both SOEs and POEs. This is consistent with the predication in our **Hypothesis II**. Furthermore, in magnitude, the coefficient of the POEs is much larger than that of state firms, indicating that the variation of ownership concentration can impose higher effects on the changes of leverage ratios in POEs than in SOEs. This result is consistent with the predication in our **Hypothesis III**.

3.8.2 Asymmetric adjustment behaviours

More recent studies suggest that firms' leverage adjustment behaviours are likely to be asymmetric when over and under-levered (Byoun, 2008 and Faulkender et al., 2012). This is one limitation of the reduced one-step approach (3.4) which only generates an overall adjustment speed coefficient but cannot examine the asymmetric adjustment behaviours. To solve this issue, we can modify equation (3.1) as:

$$\Delta L_{it} = \lambda_1 Overlevered_{it} * DEV_{it} + \lambda_2 Underlevered_{it} * DEV_{it} + \nu_{it} \qquad (3.12)$$

where $DEV_{it} = \left(\hat{L}_{it} - L_{it-1}\right)$, $Overlevered_{it}$ is a dummy variable equal to one if $DEV_{it} < 0$ otherwise equal to zero, $Underlevered_{it}$ is a dummy variable equal to one if $DEV_{it} \geq 0$ otherwise equal to zero, λ_1 is the coefficient measuring the adjustment speed for over-levered firms while λ_2 is the coefficient measuring the adjustment speed for under-levered firms.

To estimate the potential differential impact from ownership structures on the leverage adjustment behaviours of over-levered and under-levered firms, we can parametrize the adjustment speed, i.e. λ_1 and λ_2 in equation (3.12), as a linear combination of a constant and some ownership variables:

$$\lambda_1 = c_0 + c_1 Ownership_{it} \qquad (3.13)$$

$$\lambda_2 = c_2 + c_3 Ownership_{it} \qquad (3.14)$$

where $Ownership_{it}$ can be either the State ownership dummy or the High concentration indicator. Then we can replace λ_1 and λ_2 in equations (3.12) by the expressions (3.13) and (3.14), respectively and obtain our final equation as:

$$\begin{aligned}\Delta L_{it} = {} & c_0 Overlevered_{it} * DEV_{it} + c_1 Ownership_{it} * Overlevered_{it} \\ & * DEV_{it} + c_2 Underlevered_{it} * DEV_{it} + c_3 Ownership_{it} \\ & * Underlevered_{it} * DEV_{it} + \nu_{it}\end{aligned} \qquad (3.15)$$

where c_0 and c_2 are the adjustment speeds of over-levered and under-levered firms respectively, and c_1 and c_3 are the adjustment speeds affected by ownership structures for over-levered and under-levered firms respectively. If our **Hypothesis I** is correct, then $(c_1 + c_3) < 0$ when $Ownership_{it}$ is replaced by $State_{it}$. If our **Hypothesis II** is correct, then $(c_1 + c_3) > 0$ when $Ownership_{it}$ is replaced by $High\ concentration_{it}$.

The results are reported in Table 3.9. Column (1) contains the results for equation (3.12) using the full sample. Although the adjustment speed of over-levered firms is slightly higher than that of the under-levered firms, the difference between two coefficients (λ_1 and λ_2) is statistically weak. At the bottom of the table, we perform F-test under the null hypothesis that the firms present symmetric adjustment speed when they are over or under-levered. The null hypothesis cannot be rejected at conventional significant levels. This is different from the results obtained by using the US firms dataset. For instance, US firms tend to adjust their leverage ratios faster when over-levered. The possible explanation is that, for CLFs, the benefits of removing excess leverage seem to be similar to the benefits of moving towards the target leverage from below.

In column (2) of Table 3.9, we report the results for equation (3.15) by replacing $Ownership_{it}$ with $State_{it}$. The firms with state as their ultimate controllers tend to adjust insignificantly faster when over-levered but substantially slower when under-levered, compared to the firms ultimately controlled by non-state investors. The lower adjustment speed of SOEs from below may indicate that SOEs have lower incentives to take the tax advantages of debt. Meanwhile, the combination of coefficients c_1 and c_2 is indeed smaller than zero, which supports our **Hypothesis I**.

Table 3.9: Asymmetric adjustment behaviours

Dependent: $Change_{it}$	Full sample (1)	Full sample (2)	State (3)	Private (4)
$Over_{it} * DEV_{it}$	0.279***	0.219***	0.111*	0.343***
	(0.029)	(0.046)	(0.059)	(0.120)
$State_{it} * Over_{it} * DEV_{it}$		0.083		
		(0.059)		
$Under_{it} * DEV_{it}$	0.253**	0.389***	0.179**	0.295***
	(0.035)	(0.053)	(0.088)	(0.097)
$State_{it} * Under_{it} * DEV_{it}$		-0.192***		
		(0.071)		
$High_{it} * Over_{it} * DEV_{it}$			0.206***	-0.003
			(0.062)	(0.237)
$High_{it} * Under_{it} * DEV_{it}$			-0.052	0.313**
			(0.105)	(0.159)
Constant	0.002	-0.002	0.013*	0.015
	(0.004)	(0.005)	(0.007)	(0.009)
AR(2)	0.907	0.861	0.544	0.863
Hansen test	0.340	0.741	0.392	0.610
over = under	0.608	0.039	0.592	0.783
over = under (State/High)		0.093	0.004	0.118
Firms	1165	1165	648	371
Observations	9789	9789	4125	2105

This table contains the results for equations (3.12) & (3.15). System GMM results are presented. (over = under) is a null hypothesis that the over-levered adjustment speed is equal to under-levered adjustment speed. (over = under (state/high)) is a null hypothesis that the over-levered SOEs adjustment speed is equal to under-levered SOEs adjustment speed. P-values of F-tests are reported. All other information can be found in the bottom of Table 3.8. Definitions of all variables can be found in Appendix B. All standard errors are robust in brackets. P-values of AR (2) and Hansen tests are reported. Year dummies are included in all specifications. *, ** and *** correspond to P-values at 10%, 5% and 1% respectively.

We replace $Ownership_{it}$ with $High\ concentration_{it}$ in equation (3.15) and estimate the equation for SOEs and POEs. The results are reported in columns (3) and (4) of Table 3.9. For SOEs, the presence of largest shareholders owning a higher proportion of the firms' total shares can result in the increase of adjustment speed for over-levered firms by around 20% per year. This number is highly statistically significant. When under-levered, the SOEs with high level of ownership concentration are likely to adjust a little bit slower (5%) but the coefficient for the interactive term is statistically insignificant. For under-levered POEs, the coefficient for the triple interactive term is positive and large in magnitude as well as statistically significant (29%). For over-levered private firms, there is no evidence to show that ownership concentration level can impose any significant effect on leverage adjustment. Combining coefficients on the two triple interaction terms, $(c_1 + c_3)$ is larger than zero for both state and private firms, indicating that our **Hypothesis II** is valid. Also, $(c_{1\_state} + c_{3\_state}) < (c_{1\_private} + c_{3\_private})$, indicating that our **Hypothesis III** is valid as well. Notably, after controlling the effects from ownership concentration, we can see

that SOEs tend to adjust much slower than non-SOEs whenever over and under-levered. This is again consistent with the prediction in **Hypothesis I**.

The faster over-levered adjustment speed for the highly concentrated SOEs probably reflects the low asset risk preference of state agency. Over the past decade, central government in China has gradually realized the importance of controlling the indebted risks of state assets. In the official document announced by SASAC[74] in 2006, the indebtedness level is treated as one of the most important criterions for judging a state-owned firm's financial performance. Furthermore, managers of SOEs are usually holding political positions in the government and they have no incentives to work against the preference of the state. Besides, the higher the proportion of ownership concentrated in state controlling shareholders' hands, the higher the attention/ monitoring from the state agency should be. In such highly concentrated SOEs, managers may have built-in incentives to keep the firms' leverage ratio at levels lower than the optimal, indicating that they are also more likely to be engaged in leverage reduction when firms are over-levered but less likely to proactively increase leverage ratios when firms are under-levered.

The private blockholders may have strong incentives to prevent diluting of control. If the controlled firm is under-levered with high debt capacity, then the private blockholders may prefer to use more debt financing. The presence of large blockholders who have lower expropriation incentives should reduce the costs of borrowing to the controlled firms. Therefore, the controlled firms can more quickly increase their leverage ratios from below. Nevertheless, when over-levered, the coefficient for the triple interactive term is weakly negative and small in magnitude. This suggests that the external capital market is unlikely to offer flexible debt contracts to the POEs with low debt capacity, no matter whether the private blockholders have lower or higher incentives to practice expropriation.

3.8.3 Non-linear effects from ownership concentration

Lastly, several studies suggest a nonlinear relationship between ownership concentration and firm performance (e.g. Morck et al., 1988; Holderness et al., 1999; Tian, 2002). Increasing ownership concentration from a very low level provides incentives as well as powers for large shareholders to monitor the manager behaviours. However, a

[74] State-owned Assets Supervision and Administration Commission (SASAC). Details of this document can be found: http://www.sasac.gov.cn/2006rdzt/2006rdzt_0021/gzw/03/200701150269.htm

further increase in concentration may create an ambition for large shareholders to expropriate minority shareholders. When the concentration is close to 100%, the interests of controlling shareholders are completely bound up with that of the firm. In this situation, they do not have incentives to tunnel. Using the CLFs dataset, Ma and Tian (2010) find that total share ownership concentration results in an asymmetric U (V) shape of firm performance. This motivates us to test whether there is also a non-linear relation between ownership concentration and firms' leverage adjustment speed.

To examine the above inference, we firstly classify the firms into three different categories. In detail, a firm is added into the 'Low (High) concentration' group if the average percentage of its total share owned by its largest shareholder is lower (larger) than 30% (50%). If a firm's largest shareholder owns not less than 30% but not more than 50% of its total shares, this firm is added into the 'Medium concentration' group. To bypass the possible measurement errors, we estimate the one step reduced model (3.4). The results are reported in Table 3.10. In panel A, for the CLFs ultimately controlled by the state, the estimated coefficient for the lagged leverage ratio firstly increases from the Low to Medium concentration group and then decreases from the Medium to High concentration group. This means that the corresponding SOLAs of the firms in the Low and High concentration groups are larger than those of the firms in the Medium concentration group. The three different estimators share a similar tendency. These results suggest that the SOEs with a medium level of ownership concentration are more likely to suffer from the expropriation behaviours of their ultimate controllers than the SOEs with lower and higher levels of ownership concentration. In panel B, for POEs, there is an obvious linear positive relationship between the SOLA and the degree of ownership concentration, indicating that a higher level of ownership concentration may always be regarded as a sort of positive information about the governance quality of POEs in China.

Table 3.10: Non-linear effects from ownership concentration

Panel A State firms

	SYS-GMM			LSDVC			DPF		
Dependent: $Leverage_{it}$	Low (1)	Medium (2)	High (3)	Low (4)	Medium (5)	High (6)	Low (7)	Medium (8)	High (9)
$Leverage_{it-1}$	0.659*** (0.068)	0.765*** (0.053)	0.720*** (0.054)	0.683*** (0.029)	0.703*** (0.037)	0.653*** (0.034)	0.809*** (0.037)	0.870*** (0.015)	0.737*** (0.047)
AR(2)	0.962	0.947	0.468						
Hansen test	0.789	0.247	0.655						
Firms	175	287	190				175	287	190
N	1124	1837	1193	1263	2061	1340	1263	2061	1340

Panel B Private firms

Dependent: $Leverage_{it}$	Low (1)	Medium (2)	High (3)	Low (4)	Medium (5)	High (6)	Low (7)	Medium (8)	High (9)
$Leverage_{it-1}$	0.603*** (0.062)	0.545*** (0.123)	0.410** (0.173)	0.624*** (0.041)	0.520*** (0.047)	0.359*** (0.076)	0.754*** (0.028)	0.647*** (0.055)	0.441*** (0.092)
AR(2)	0.942	0.308	0.868						
Hansen test	0.556	0.112	0.696						
Firms	142	159	44				142	159	44
N	784	734	197	847	783	210	847	783	210

This table contains the coefficient on lagged leverage ratio in equation (3.4). A firm is added into '**Low (High) concentration**' group if the percentage of its total share owned by its largest shareholder is smaller (larger) than 25% (50%). If a firm's largest shareholder owns not less than 25% but not larger than 50% of its total shares, then this firm will be added into '**Medium concentration**' group. All standard errors are robust in brackets. P-values of AR (2) and Hansen tests are reported for GMM estimator. Year dummies are included in all specifications. Econometric specification is similar with the information presented at the bottom of Table 3.4. *, ** and *** correspond to P-values at 10%, 5% and 1% respectively.

3.9 Conclusion

Capital structure is not only the result of various financial characteristics of the firm but is also determined by the decision-makers' choices (Pindado and La Torre, 2011). Ownership structure can be characterised by the degree of conflicts among decision-makers and it has been proved to be an important determinant to variations of observed capital structures across firms. In this chapter, we use the Chinese listed firms (CLFs) dataset to test the effects from state ownership and concentration of ownership on firm's leverage adjustment behaviour.

We find that the trade-off theory, initially developed for US firms, presents decent explanatory power for the capital structure changes of CLFs. The results obtained from the one-step reduced dynamic leverage model show that the speed of leverage adjustment (SOLA) for CLFs should be around 25% to 30% per year. In the sample separation tests, we find that SOEs present lower SOLA than POEs. The relatively lower bankruptcy pressure together with the lower incentive to use interest expenses of debt to shield against corporate income tax can be the possible reasons for us to observe the less important role played by the deviations from optimal leverage ratio in determining the financing decisions of SOEs. Furthermore, the CLFs with more concentrated ownership structure present higher SOLA. We interpret this result as evidence for the argument that firms with less complex ownership structures, i.e. higher level of ownership concentration, may face lower costs of adjustment in the capital market as they are likely to be considered as safer borrowers with controlling shareholders who have lower incentives to expropriate resources away from the firms. Given lower costs of adjustment, the firms with higher ownership concentration should naturally present higher adjustment speed of leverage. This positive relation is more significant in POEs than in SOEs. A possible reason is that the behaviours of SOEs are affected by government intervention.

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Appendix B

Book Leverage: (Short term debt + Long term debt + Bond payable) / Total assets

Size: Log (Real sales)

Age: Current year – Established year

Cash: Cash&Cash equivalent / Total assets

Profitability: Earnings before interest and tax / Total assets

Tangibility: Fixed assets / Total assets

Non-debt tax shields: Depreciation divided by total assets

Other receivable (OACR): Other account receivable / Total assets

Sales growth: Changes of logarithm of real sales

Assets growth: Changes of logarithm of real total assets

Tobin Q: (Market value of Equity + Market value of Net debt) / Total assets

Industry Classification: SIC 12 categories

Listed age: Listed year – current year

Non-debt tax shields: Depreciation / Total assets

Largest shareholder is the percentage of total shares held by the largest shareholder.

Fixed investment: (Changes of fixed assets + depreciation)/beginning of period fixed assets

Time variant State ownership dummy: Equal to one if a firm-year observation presents State agency as ultimate controller, otherwise equal to zero, i.e. non-state owned firms.

Time invariant State ownership dummy: Equal to one if a firm has not less than 60% observations ultimately controlled by state agency, otherwise equal to zero, i.e. non-state owned firms.

Time variant Private ownership dummy: Equal to one if a firm-year observation presents State agency as ultimate controller, otherwise equal to zero, i.e. non-state owned firms.

Time invariant Private ownership dummy: Equal to one if a firm has not less than 60% observations ultimately controlled by private investor, otherwise equal to zero.

Time variant High (low) concentration: If the percentage of its total shares held by its largest shareholder at year t is above (below) the sample average of this percentage for all the firm-year observations.

Time invariant High (low) concentration: If the averaged percentage of its total shares held by its largest shareholder is above (below) the sample average of this percentage for all the firm-year observations.

Table B.11: Full version of Table 3.5

Panel A Ownership types

	System GMM		LSDVC		DPF	
Dependent: $Lever_{it}$	State (1)	Private (3)	State (4)	Private (6)	State (7)	Private (9)
$Lever_{it-1}$	**0.773*** (0.029)**	**0.719*** (0.048)**	**0.711*** (0.009)**	**0.727*** (0.018)**	**0.764*** (0.015)**	**0.778*** (0.024)**
Long term effects:						
MB_{it-1}	-0.028* (0.016)	-0.011 (0.011)	-0.017*** (0.006)	-0.006 (0.011)	-0.035*** (0.009)	-0.027** (0.013)
$Size_{it-1}$	0.034 (0.029)	0.061*** (0.023)	0.064*** (0.008)	0.035** (0.017)	0.049*** (0.011)	0.013 (0.019)
$Profit_{it-1}$	0.808** (0.344)	0.236 (0.319)	0.108** (0.059)	-0.002 (0.107)	0.501*** (0.098)	0.235 (0.146)
$Tang_{it-1}$	0.088 (0.081)	0.011 (0.132)	0.000 (0.039)	0.121 (0.077)	-0.073 (0.054)	0.115 (0.095)
$NDTS_{it-1}$	-1.889** (0.912)	-1.935 (1.358)	-1.403*** (0.435)	-3.059*** (0.987)	-1.965*** (0.591)	-3.865*** (0.095)
$Indlev_{it-1}$	0.775*** (0.193)	0.527* (0.271)	0.590*** (0.084)	0.180 (0.213)	0.539*** (0.111)	0.186 (0.258)
R-squared					39.07%	40.42%
AR(2)	0.649	0.433				
Hansen test	0.207	0.205				
Firms	884	458	884	458	884	458
N	8632	3322	8632	3322	8632	3322

Panel B Ownership types (exclude ST/distressed firms)

Dependent: $Lever_{it}$	State (1)	Private (3)	State (4)	Private (6)	State (7)	Private (9)
$Lever_{it-1}$	**0.753*** (0.033)**	**0.630*** (0.039)**	**0.705*** (0.014)**	**0.662*** (0.031)**	**0.806*** (0.020)**	**0.630*** (0.039)**
Long term effects						
MB_{it-1}	-0.046* (0.024)	-0.009 (0.009)	-0.015** (0.007)	-0.004 (0.011)	-0.031** (0.012)	-0.010 (0.014)
$Size_{it-1}$	0.054** (0.021)	0.016 (0.014)	0.029*** (0.010)	-0.012 (0.020)	-0.023 (0.018)	-0.072** (0.029)
$Profit_{it-1}$	0.581 (0.425)	-0.249 (0.167)	0.095 (0.088)	-0.121 (0.159)	0.583*** (0.167)	0.055 (0.217)
$Tang_{it-1}$	0.445** (0.219)	0.003 (0.102)	-0.035 (0.044)	0.127 (0.082)	-0.156** (0.074)	0.109 (0.108)
$NDTS_{it-1}$	-1.112 (2.519)	-2.580** (1.271)	-1.695*** (0.492)	-2.966*** (1.103)	-2.457*** (0.783)	-3.996*** (1.525)
$Indlev_{it-1}$	0.274 (0.259)	0.579*** (0.209)	0.590*** (0.084)	0.265 (0.206)	0.467*** (0.137)	0.166 (0.265)
R-squared					35.52%	29.69%
AR(2)	0.745	0.378				
Hansen test	0.104	0.630				
Firms	652	345	652	345	652	345
N	6290	2174	6290	2174	6290	2174

This table is the full version of Table 3.5. The coefficients on the independent variables, other than the lagged leverage ratio, capture their long-term effects on leverage choice. The calculation is: $\beta = \theta/(1-\gamma)$. See equation (3.4) for more detail.

Table B.12: Full version of Table 3.6

Panel A State Firms

	System GMM		LSDVC		DPF	
Dependent:	Low	High	Low	High	Low	High
$Lever_{it}$	(1)	(2)	(3)	(4)	(5)	(6)
$Lever_{it-1}$	**0.723*** **	**0.706*** **	**0.696*** **	**0.694*** **	**0.827*** **	**0.791*** **
	(0.058)	**(0.040)**	**(0.030)**	**(0.025)**	**(0.025)**	**(0.025)**
Long term effects						
MB_{it-1}	0.104**	0.012	-0.032**	-0.001	-0.079***	-0.032*
	(0.053)	(0.017)	(0.013)	(0.016)	(0.023)	(0.017)
$Size_{it-1}$	0.117***	0.099***	0.049*	0.058***	0.051*	0.056***
	(0.044)	(0.024)	(0.025)	(0.017)	(0.030)	(0.020)
$Profit_{it-1}$	0.534**	-0.022	0.503***	0.106	1.401***	0.577***
	(0.249)	(0.218)	(0.099)	(0.098)	(0.306)	(0.189)
$Tang_{it-1}$	0.046	0.149	-0.089	-0.054	0.093	-0.222**
	(0.268)	(0.104)	(0.107)	(0.093)	(0.134)	(0.108)
$NDTS_{it-1}$	2.058	-1.242	-1.772*	-1.600*	-5.521***	-2.829***
	(3.394)	(1.035)	(1.065)	(0.820)	(1.809)	(1.090)
$Indlev_{it-1}$	0.943***	0.551**	0.056	0.315*	0.582*	0.454**
	(0.293)	(0.250)	(0.273)	(0.162)	(0.310)	(0.232)
R-squared					0.502	0.368
AR(2)	0.570	0.536				
Hansen test	0.587	0.128				
Firms	365	495			365	495
N	2377	3132	2377	3132	2685	3530
Panel B Exclude ST/distressed firms						
Dependent:	Low	High	Low	High	Low	High
$Lever_{it}$	(1)	(2)	(3)	(4)	(5)	(6)
$Lever_{it-1}$	**0.827*** **	**0.778*** **	**0.730*** **	**0.647*** **	**0.861*** **	**0.796*** **
	(0.079)	**(0.043)**	**(0.032)**	**(0.038)**	**(0.016)**	**(0.031)**
Long term effects						
MB_{it-1}	-0.056*	-0.036**	-0.030*	-0.000	-0.077***	-0.018
	(0.029)	(0.017)	(0.017)	(0.011)	(0.028)	(0.017)
$Size_{it-1}$	-0.007	0.003	0.001	0.035***	-0.061	-0.011
	(0.023)	(0.009)	(0.035)	(0.011)	(0.043)	(0.024)
$Profit_{it-1}$	0.947	0.537**	0.353	-0.051	1.136***	0.444*
	(0.689)	(0.268)	(0.233)	(0.120)	(0.364)	(0.239)
$Tang_{it-1}$	0.032	0.095	-0.094	-0.072	0.090	-0.255**
	(0.123)	(0.084)	(0.073)	(0.060)	(0.188)	(0.115)
$NDTS_{it-1}$	-1.281	-1.083	-4.126*	-1.224**	-8.723***	-2.024*
	(1.204)	(0.785)	(2.111)	(0.584)	(2.433)	(1.101)
$Indlev_{it-1}$	0.765***	0.750***	-0.162	0.248	0.401	0.282
	(0.205)	(0.155)	(0.261)	(0.201)	(0.384)	(0.233)
R					0.419	0.328
AR(2)	0.666	0.727				
Hansen test	0.149	0.210				
Firms	262	390			262	390
N	1696	2458	1696	2458	1909	2755

This table is the full version of Table 3.6. The coefficients on the independent variables, other than the lagged leverage ratio, capture their long-term effects on leverage choice. The calculation is: $\beta = \theta/(1-\gamma)$. See equation (3.4) for more detail.

Table B.13: Full version of Table 3.7

Panel A Private Firms

	System GMM		LSDVC		DPF	
Dependent: $Lever_{it}$	Low (1)	High (2)	Low (3)	High (4)	Low (5)	High (6)
$Lever_{it-1}$	**0.776*** (0.101)**	**0.513*** (0.112)**	**0.639*** (0.031)**	**0.526*** (0.051)**	**0.788*** (0.034)**	**0.699*** (0.058)**
Long term effects						
MB_{it-1}	-0.028* (0.017)	-0.005 (0.009)	-0.013 (0.009)	0.004 (0.014)	-0.050*** (0.019)	0.006 (0.020)
$Size_{it-1}$	0.022 (0.017)	0.027** (0.011)	0.056** (0.025)	0.026 (0.034)	0.036 (0.031)	-0.025 (0.033)
$Profit_{it-1}$	0.775 (0.485)	-0.046 (0.127)	0.036 (0.119)	-0.057 (0.166)	0.269 (0.212)	0.285 (0.250)
$Tang_{it-1}$	0.270** (0.128)	0.068 (0.090)	0.126* (0.071)	0.068 (0.085)	0.248* (0.121)	0.098 (0.154)
$NDTS_{it-1}$	-3.785 (2.400)	0.721 (0.794)	-3.638** (1.753)	0.085 (1.387)	-7.120*** (2.131)	-1.000 (1.825)
$Indlev_{it-1}$	0.449** (0.208)	0.245 (0.159)	-0.274 (0.309)	-0.486* (0.266)	0.615 (0.440)	-0.478 (0.438)
R-squared					0.398	0.217
AR(2)	0.282	0.166				
Hansen test	0.423	0.209				
Firms	266	178			266	178
N	1512	856	1512	856	1661	925
Panel B Exclude ST/distressed firms						
Dependent: $Lever_{it}$	Low (1)	High (2)	Low (3)	High (4)	Low (5)	High (6)
$Lever_{it-1}$	**0.753*** (0.097)**	**0.415*** (0.109)**	**0.628*** (0.042)**	**0.460*** (0.069)**	**0.773*** (0.048)**	**0.579*** (0.059)**
Long term effects						
MB_{it-1}	-0.026 (0.017)	-0.019** (0.009)	-0.000 (0.009)	-0.008 (0.016)	-0.018 (0.018)	-0.007 (0.018)
$Size_{it-1}$	-0.005 (0.024)	0.027*** (0.010)	-0.012 (0.021)	0.011 (0.020)	-0.100** (0.051)	-0.015 (0.026)
$Profit_{it-1}$	0.216 (0.331)	-0.119 (0.139)	-0.224 (0.182)	-0.087 (0.233)	0.102 (0.311)	0.075 (0.241)
$Tang_{it-1}$	0.206* (0.123)	0.144 (0.088)	-0.015 (0.082)	0.041 (0.074)	0.070 (0.166)	0.097 (0.122)
$NDTS_{it-1}$	-2.291 (1.465)	0.062 (0.826)	-2.252 (1.614)	0.814 (0.987)	-5.975** (2.473)	0.470 (1.586)
$Indlev_{it-1}$	0.485** (0.224)	0.283* (0.168)	0.009 (0.323)	-0.248 (0.240)	0.780* (0.430)	-0.351 (0.331)
R-squared					0.291	0.146
AR(2)	0.652	0.242				
Hansen test	0.485	0.386				
Firms	193	152			193	152
N	1025	690	1025	690	1103	737

This table is the full version of Table 3.7. The coefficients on the independent variables, other than the lagged leverage ratio, capture their long-term effects on leverage choice. The calculation is: $\beta = \theta/(1-\gamma)$. See equation (3.4) for more detail.

Table B.14: Multicollinearity test for specification in column (2) of Table 3.9

Panel A

Variables	VIF	SQRT VIF	Tolerance	R-Squared
$Over_{it} * DEV_{it}$	1.78	1.33	0.562	0.437
$Under_{it} * DEV_{it}$	3.00	1.73	0.334	0.666
$State_{it} * Over_{it} * DEV_{it}$	1.57	1.25	0.636	0.364
$State_{it} * Under_{it} * DEV_{it}$	2.72	1.65	0.367	0.633
Mean VIF	2.27			

Panel B

Dimension	Eigenvalue	Cond Index
1	2.4723	1.0000
2	1.7587	1.1856
3	0.3890	2.5209
4	0.2459	3.1707
5	0.1341	4.2932
Condition Number	4.2932	

Table B.15: Multicollinearity test for specification in column (3) of Table 3.9

Panel A

Variables	VIF	SQRT VIF	Tolerance	R-Squared
$Over_{it} * DEV_{it}$	1.75	1.32	0.571	0.429
$Under_{it} * DEV_{it}$	2.59	1.61	0.386	0.613
$High_{it} * Over_{it} * DEV_{it}$	1.52	1.23	0.660	0.340
$High_{it} * Under_{it} * DEV_{it}$	2.29	1.51	0.436	0.564
Mean VIF	2.04			

Panel B

Dimension	Eigenvalue	Cond Index
1	2.4204	1.0000
2	1.7191	1.1866
3	0.4411	2.3423
4	0.2705	2.9913
5	0.1489	4.0315
Condition Number	4.0315	

Table B.16: Multicollinearity test for specification in column (4) of Table 3.9

Panel A

Variables	VIF	SQRT VIF	Tolerance	R-Squared
$Over_{it} * DEV_{it}$	1.76	1.33	0.567	0.433
$Under_{it} * DEV_{it}$	1.65	1.29	0.604	0.395
$High_{it} * Over_{it} * DEV_{it}$	1.47	1.21	0.681	0.319
$High_{it} * Under_{it} * DEV_{it}$	1.38	1.17	0.725	0.274
Mean VIF	1.57			

Panel B

Dimension	Eigenvalue	Cond Index
1	2.2655	1.0000
2	1.6108	1.1859
3	0.5577	2.0156
4	0.3886	2.4146
5	0.1775	3.5727
Condition Number	3.5727	

Table B.17: Examples for leverage of firms in Very High Portfolio

ID / Year	522	585	628	600620	600778
2000	0.577	0.434	0.357	0.510	0.358
2001	0.488	0.420	0.313	0.578	0.292
2002	0.530	0.315	0.403	0.446	0.323
2003	0.499	0.204	0.485	0.485	0.314
2004	0.519	0.132	0.508	0.403	0.290
2005	0.480	0.066	0.474	0.479	0.301
2006	0.501	0.052	0.281	0.357	0.254
2007	0.447	0.046	0.209	0.325	0.174
2008	0.466	0.026	0.179	0.235	0.137
2009	0.413	0.030	0.189	0.428	0.098
2010	0.334	0.040	0.113	0.160	0.139

522: Guangzhou Baiyunshan Pharmaceutical Co., Ltd. (SOE), Medical
585: Northeast Electric Development Co. Ltd. (non-SOE), Equipment
628: Chengdu Hi-tech Dev (SOE), Real estate
600620: Shanghai Tianchen Co., Ltd (non-SOE), General
600778: Xinjiang Youhao (Group) CO., LTD (SOE), Retailing

Table B.18: Examples for leverage of firms in High Portfolio

ID / Year	40	701	739	200706	600774
2000	0.291	0.271	0.214	0.236	0.250
2001	0.351	0.273	0.330	0.291	0.370
2002	0.440	0.272	0.326	0.310	0.397
2003	0.408	0.275	0.362	0.301	0.304
2004	0.352	0.245	0.441	0.287	0.382
2005	0.325	0.299	0.413	0.212	0.339
2006	0.344	0.229	0.344	0.251	0.336
2007	0.211	0.341	0.284	0.214	0.295
2008	0.276	0.165	0.287	0.165	0.275
2009	0.245	0.143	0.240	0.220	0.283
2010	0.130	0.120	0.268	0.205	0.251

40: Shenzhen Jihong Co., Ltd. (SOE), Real estate
701: Xiamen Xindeco (SOE), General
739: Wafangdian Bearing (non-SOE), Equipment
200706: Apeloa (non-SOE), Medical
600774: Wuhan Hanshang Group Co., Ltd. (SOE), Retailing

Table B.19: Examples for leverage of firms in Medium Portfolio

ID / Year	2	419	837	952	600051
2000	0.114	0.182	0.189	0.142	0.182
2001	0.248	0.173	0.282	0.210	0.152
2002	0.075	0.209	0.249	0.225	0.297
2003	0.183	0.272	0.218	0.289	0.360
2004	0.109	0.243	0.242	0.319	0.288
2005	0.095	0.277	0.242	0.276	0.188
2006	0.252	0.273	0.187	0.270	0.097
2007	0.174	0.220	0.184	0.079	0.115
2008	0.115	0.230	0.159	0.067	0.188
2009	0.135	0.218	0.187	0.212	0.213
2010	0.121	0.263	0.113	0.237	0.167

2: Vanke (SOE), Real estate
419: Changsha Tongcheng (SOE), Retailing
837: Shaanxi Qinchuan Machinery Development Co., Ltd. (SOE), Equip.
952: Hubei Guangji Pharmaceutical Co., Ltd. (SOE), Medical
600051: Ningbo United Group Co., Ltd. (SOE), Retailing

Table B.20: Examples for leverage of firms in Low Portfolio

ID / Year	31	153	617	600643	600697
2000	0.056	0.066	0	0.110	0.027
2001	0.139	0.091	0.032	0.203	0.086
2002	0.120	0.063	0.125	0.087	0.087
2003	0.149	0.101	0	0.142	0.070
2004	0.238	0.191	0	0.116	0.136
2005	0.218	0.281	0.086	0.194	0.121
2006	0.305	0.238	0.217	0.234	0.188
2007	0.247	0.160	0.266	0.131	0.139
2008	0.367	0.187	0.171	0.134	0.158
2009	0.252	0.233	0.226	0.142	0.114
2010	0.371	0.189	0	0.161	0.120

31: COFCO Property (Group) (SOE), Real estate
153: Anhui Fengyuan (SOE), Medical
617: Ji'nan Diesel Engine Co., Ltd. (SOE), Equipment
600643: Shanghai Aijian co., Ltd. (non-SOE), General
600697: Chang Chun Eurasia Group Co. Ltd (SOE), Retailing

Further sample description:

The annual firm-level dataset is drawn from China Stock Market & Accounting Research (CSMAR) database. Different from the NBS dataset, the CSMAR dataset contains significantly less number of firms. Nevertheless, the data quality of CSMAR dataset should be much better than that of the NBS dataset, since the former is the pure accounting record or the information extracted from the stock market while the latter is the census like data which may contain some systematic recording issues. More importantly, the unlisted firms in NBS dataset do not report many of their financial variables, e.g. financial debt. In the CSMAR dataset, however, most of financial variables that will be used in our research are clearly identified. Major corporate governance indicators are also non-existent in the NBS dataset but are reported in detail by the CSMAR dataset. To explore the potential long-term effects from the 4 trillion RMB fiscal stimulus plan on firms' behaviours, we have also extended the CSMAR dataset to the end of 2016 in Chapter 4.

Table B.21: Number of firms with different ownership structures in each year

	State Firms	Private Firms	Other Firms	Top 1 Largest	Top 3 Largest	Top 5 Largest	Top 10 Largest
1999	653	53	146				
2000	736	75	157				
2001	781	94	154				
2002	784	144	150				
2003	778	217	134	43%	55%	59%	61%
2004	788	289	135	42%	55%	59%	61%
2005	790	307	113	40%	54%	57%	60%
2006	762	373	122	36%	48%	52%	56%
2007	764	450	135	35%	47%	51%	55%
2008	800	499	118	36%	48%	50%	54%
2009	775	511	53	36%	47%	50%	54%
2010	671	474	50	36%	47%	54%	54%

All ownership indicators are time variant. The 'Other' category includes: foreign firms, collective firms and so on. 'Top 1 Largest' means the proportion of shares hold by the first largest shareholder. 'Top 3 Largest' means the sum of proportions of shares owned by the first 3 largest shareholders. Similarly, the 'Top 5' and 'Top 10' indicate the first 5 and 10 largest shareholders respectively.

Table B.22: Industry distribution

	Full sample	State	Private
Agriculture	286	161	109
Mining	144	130	9
Manufacturing	9026	5516	2222
Construction	270	185	63
Transportation	23	15	6
Technology	860	473	300
Retailing	1173	829	188
Real estate	1159	614	341
Service	366	225	64
Media	51	48	0
Other	805	423	241

SIC 2001 version

Chapter 4

Short debt maturity and corporate investment: New evidence from Chinese listed firms

4.1 Introduction

The recent debt refinancing problem in China has aroused widespread concern. For example, in the economy, the share of short-term external debt in the overall external debt grew to 78% at the end of 2013 (Sun, 2015). According to an IMF report, the China non-financial corporate debt ratio approached 169% of its GDP in the first quarter of 2016 and more than half of these debts will come due in less than 3 years (Maliszewski et al., 2016). The declining profitability of the corporate sector may further deteriorate the economy's repayment ability as a whole (Chivakul and Lam, 2015). In this chapter, we use the Chinese listed firms (CLFs) dataset over 1998 – 2016 to explicitly study the impact from short debt maturity on capital expenditures through the channel of rollover risk.

The effect of capital structure related decisions on corporate investment is a fundamental issue in corporate finance. In their seminal paper, Modigliani and Miller (1958) show that in a complete and perfect capital market, capital structure is irrelevant to a firm's investment decisions. By relaxing the perfect capital market assumption, Myers (1977) firstly demonstrates a debt overhang concept that if risky debt matures **after** the expiration of investment option, then the equity value maximizing shareholder-management coalition will have lower incentive to invest in the positive NPV project since the benefits accrue, at least partially, to debtholders. To avoid such an underinvestment issue, managers can implement a policy of rolling over shorter term debt since a contract with shorter maturity offers more space for renegotiation between equityholders and debtholders before the expiration of growth opportunities. Nevertheless, the flexibility of short-term debt is accompanied by high rollover loss (Bodie and Taggart, 1978 and Flannery, 1986). As the short-term issues are rolled over, the firm suffers the full consequences of any undervaluation (Barnea et al., 1980), interest rate changes (Wall, 1989) and sub-optimal liquidations (Diamond, 1991 and Sharp, 1991).

Empirically, several studies indeed detect a significant negative relation from debt maturity to a firm's capital expenditure (Aivazian et al., 2005b and Dang, 2011), indicating that longer term debt can generate larger overhang costs and hence less investment incentives. Nevertheless, the mainstream literature on debt maturity has only applied theories to the behaviours of firms from developed economies with very mature capital markets. A common feature of these firms' capital structure decisions is that they mainly rely on long-term debt financing and merely regard short-term debt as complementary over

time. Specifically, the averaged ratio of long-term debt to total debt is 0.72 in the US, 0.59 in France and 0.53 in Germany (Barclay and Smith, 1995 and Antoniou et al., 2006). In such a situation, the (negative) impact from short-term debt usage, e.g. rollover risk, on firms' real economic decisions may be difficult to fully investigate.

In the Chinese economy, the relatively immature capital market together with a bank dominating financial system results in the prevalence of heavy reliance on short-term debt financing among non-financial companies. For example, Cai et al. (2008) first notice that Chinese (listed) firms have an abnormally low average ratio of long-term debt to total debt, i.e. 0.23, compared to the firms in the above mentioned developed economies. This feature of capital structure decisions of Chinese (listed) firms offers us an excellent chance to analyse the systematic role played by short-term debt in determining firms' real decisions. The primary reason for us to concentrate on investment behaviour is that fixed capital accumulation has been a significant determinant of economic growth in China over the past one to two decades (Ding and Knight, 2009; 2011).

Although short-term debt can provide low interest advantages at the moment, over reliance on it can make firms suffer from high rollover risk which will in turn substantially increase costs of future borrowing (Goplalan et al., 2014 and Wang et al., 2016). Therefore, we argue that in an economy where short-term bank loan is the major financing resource, such as that of China, firms with shorter debt maturity tend to suffer more from potential rollover risks, and hence are more likely to cut their near future capital expenditures. Furthermore, Diamond and He (2014) theoretically prove that a short-term debtholder does not share as much risk as a long-term debtholder and that this leads to more volatile earnings and equity value, and hence larger overhang costs when a firm's assets-in-place deteriorates. Since firms in China are subject to more stringent lending conditions than the firms in developed economies (Allen et al., 2008), their debt refinancing activities are more likely to be affected negatively by deterioration in their own financial health or contraction in outside credit-supply.

To test our hypotheses, we estimate a classical investment regression augmented by leverage and short debt maturity (Lang et al., 1996 and Aivazian et al., 2005b). Using the full sample, the first-differenced GMM results generate a significantly negative coefficient on short debt maturity term. The results show that a 10% increase in the sample average value of short debt maturity will lead to a reduction in fixed investment by 0.03, i.e. around

11% of the sample average investment value. This indicates that firms in China indeed invest less when they have shorter debt maturity. We further classify firms into different groups according to their own financial health conditions, measured by liquidity ratio, solvency and Z-score. The sample separation tests clearly show that the firms with relatively bad financial conditions are more likely to suffer from the rollover risk associated with shorter debt maturity and present lower capital expenditures. More specifically, the absolute value of coefficient on short debt maturity is much larger for the firms in the group marked as low liquidity/ solvency/ Z-score. These results are consistent with our hypothesis that shorter debt maturity imposes a larger overhang effect on the investment of firms with worse financial health.

The 2008 financial crisis is regarded as an exogenous credit shock which amplified the negative impact from credit risk by dramatically increasing the rollover risk in the whole capital market. Most recent studies find that the firms that used more short-term debt pre-crisis or had a large amount of debt due in 2008 cut their investment expenditures much more during and after the crisis than otherwise similar firms who had less refinancing requirements when the crisis happened (Almeida et al., 2011 and Kalemli-Ozcan et al., 2015). Nevertheless, the situation is different in China. At the end of 2008, the central government proposes a 4 trillion fiscal stimulus plan implemented in 2009 and 2010. In other words, the credit-supply condition should be tighter before the crisis in the Chinese economy. Therefore, if we classify the sample into before and after the financial crisis, then we are actually comparing firms' behaviours in the periods with and without a credit boom. Our results show that the negative effect of shorter debt maturity on investment becomes much smaller after the year 2008 than before. This indicates that the rollover risk faced by firms may be temporarily reduced by the injection of more long-term bank loans due to the implementation of government policy. However, some scholars argue that the fiscal stimulus plan was carried out at the expense of future long-term economic growth in China (Chen et al., 2017 and Cong et al., 2017).

We also test the ownership effect on the debt-investment relation. SOEs in China are believed to have soft budget constraints as well as much lower default costs of debt than non-SOEs (Fan et al., 2013). For example, SOEs are able to borrow more long-term bank loans at lower interest costs (Liu et al., 2011). Therefore, compared with non-SOEs, SOEs should face lower rollover pressure and hence should present lower sensitivity of investment to short debt maturity. Nevertheless, due to strong government intervention,

SOEs are also likely to suffer from inefficient investment decisions which can result in poor financial performances (Fan et al. 2007). Based on the hypothesis that financially weak firms suffer more from the refinancing problem associated with high reliance on short-term debt, investments of SOEs may be more sensitive to the variation of short-term indebtedness than those of non-SOEs. These two contrasting predictions motivate us to do detailed sample separation tests between SOEs and non-SOEs. Our results show that the investments of SOEs are negatively affected by shorter debt maturity but the corresponding marginal impact from shorter debt maturity on the investments of SOEs is much lower than that of non-SOEs. Therefore, to be consistent with the argument in many previous Chinese studies, we conclude that soft budget constraints may reduce the importance of financial variables for SOEs' investment decisions.

In the robustness tests, we first clarify the concept of over-reliance on short-term debt. Theoretically, firms can choose a shorter but optimal maturity structure by balancing the interest benefits and the rollover costs of short-term debt (Jun and Jen, 2003). Therefore, the firms with an excessive proportion of short-term debt in their debt structure tend to suffer more from refinancing pressure and hence have lower incentives to take positive growth opportunities. Using predicted short debt maturity as well as industry median value of this variable as the target short debt maturity, we indeed find that only the firms with the level of short debt maturity higher than the optimal tend to reduce investment expenditures. Furthermore, we have also considered the potential effects from time variant financial health indicators, industry characteristics and alternative definitions to regression variables. Our major inference does not change significantly.

Our research contributes to previous literature in the following aspects. First, we provide new systematic evidence on the impact of short-term debt on a firm's investment incentives. Several recent theoretical studies propose mixed predictions about the potential impact from short-term debt usage on a firm's real economic decisions (Moyen, 2007 and Diamond and He, 2014). The major reason is that the overhang costs generated by debt with different maturities are likely to be state contingent. Our work explicitly considers such a problem. Second, previous empirical studies using US and EU firms' dataset show that the underinvestment issue caused by shorter debt maturity is either non-existent or only appearing during a time of financial crisis (Almeida et al., 2011 and Kalemli-Ozcan et al., 2015). Nevertheless, we find that in an economy with the prevalence of heavy reliance on short-term debt financing, underinvestment associated with short debt maturity should

be a common phenomenon among firms. The corresponding implication of our results may be useful for some other emerging economies in which firms face high costs of long-term financing. Furthermore, Custodio et al. (2013) first notice that the financing of US firms has gradually shifted from long-term debt to short-term debt over the past two to three decades and that this change definitely exposes these firms to credit and liquidity shocks. Therefore, our results may also be generalized to developed economies, in certain aspects. Lastly, to the best of our knowledge, no past literature has studied the relation between investment and debt maturity by using the Chinese firms dataset. We fill this gap and conduct comprehensive analyses.

The structure of this chapter follows: Section 2 is the literature review. Section 3 describes the Chinese background. Section 4 develops our working hypotheses. Section 5 explains the empirical methods. Section 6 provides data descriptions and some stylized facts. Section 7 reports the regression results. Section 8 conducts robustness tests. Section 9 concludes our main findings.

4.2 Literature review

The plausible causal relation from debt maturity to corporate investment can be traced back to an idea in a seminal paper by Myers (1977), who proposes the concept of debt overhang. In detail, a firm with assets comprising risky debt has to pay a premium to debtholders. If debt matures **after** the expiration of the investment option, then the equity value maximizing shareholder-management coalition will have lower incentive to invest in the positive NPV project since the benefits accrue, at least partially, to debtholders. In some extreme cases, e.g. the costs of investment plus the costs of debt larger than the return of the project, the growth opportunity will even be abandoned. One possible method to avoid such underinvestment issue is by shortening the maturity of outstanding debt. [75] The key assumption is that shorter term debt matures before the expiration of growth option, which offers a space for shareholders and debtholders to renegotiate the debt contract so as to reduce the promised payment to creditors below the NPV of investment.

[75] Myers (1977) also discuss other possible methods: e.g. rewriting/ renegotiating the debt contract; mediation; dividend restrictions; monitoring and protective covenants; development of secondary markets for real assets.

Therefore, it seems that permanent debt capital is best obtained by a policy of rolling over shorter term debt.

Nevertheless, the conventional idea indicates that firms should avoid relying on short-term debt since the flexibility of short-term debt is accompanied by high potential rollover risks. For example, Bodie and Taggart (1978) mention that a firm's choice of long-term debt may either reflect a desire to avoid transaction costs or a fear of credit rationing. Barnea et al. (1980) argue that the degree of undervaluation of each single short-term debt issuance may be smaller than for a bond with a maturity equal to the revelation period; but as the short-term issues are rolled over, the firm suffers the full consequences of any realised or foreseeable undervaluation. Similarly, Flannery (1986) argues that a firm without a signalling requirement should choose long-term debt over short-term debt since the former can eliminate or substantially postpone the effects of uncertainty about the refinancing rate, e.g. interest rate changes (Wall, 1989). Additionally, given the relatively higher rollover frequency of short-term contracts, borrowers also face a higher possibility of undergoing sub-optimal liquidation as the short-term lenders tend to ignore the value of future control rents and will choose to liquidate whenever sign appears to show that the amount that can be pledged is less than the value received from liquidation. Without very appropriate handling of contracting problems, this excessive liquidation issue is difficult to solve (Diamond, 1991). In contrast, long-term debt alleviates incentive problems by shifting some of the financing costs from bad to good states of nature, but without the complexity of a fully explicit contingent contract (Sharp, 1991). Overall, the symptom of short-term debt overhang caused by rollover losses may generate even stronger underinvestment incentives.

The conflicting opinions above motivate more systematic studies for the possible differential impact from short-term and long-term debts on firms' investment. For instance, Gertner and Scharfstein (1991) model the reorganization process to a financially distressed firm and show that short-term debt has more *ex post* negative effect on investment. Moyen (2007) measures overhang costs with long-term debt or short-term debt quantitatively. Moyen focuses on an assumed asymmetry in leverage adjustment such that leverage cannot be adjusted if there is long-term debt but can be adjusted every period if short-term debt is issued. In worse income shocks, short-term debt overhang is smaller than long-term debt overhang since the firm can reduce its leverage. As income shocks improve, the firm can take advantage of tax shields by using more short-term debt but the default probability, and

consequently the overhang problem, remains present, i.e. short-term debt overhang surpasses long-term debt overhang in better income shocks. Nevertheless, the overall overhang effect is similar across both maturity structures. More recently, Diamond and He (2014) use a Black-Scholes-Merton model to further introduce the concept of contingent overhang. They show that if a firm invests immediately before the release of any new information about the value of existing assets, the overhang at the current time is just the equally-weighted average of all possible future levels of overhang in different states. In this situation, shorter term debt imposes a lower overhang since it is less sensitive to the variation of firm value. In contrast, if the investment opportunity appears after some resolution of uncertainty about existing assets but before short-term debt has matured, then the shorter term debt can impose a stronger negative effect on investment incentives when the released information implies the deterioration of assets-in-place. The reason is that sharing of less risk by shorter-term debt holders implies more volatile earnings and equity value, and hence larger debt overhang.

Empirically, Aivazian et al. (2005b) firstly present a significant negative relation between debt maturity and investment in non-financial firms with high growth opportunities. This is consistent with the idea that debt overhang costs are larger for firms with more growth options. Considering the possible endogenous relation that firms could mitigate the underinvestment problem by lowering the debt maturity if future growth opportunities are recognized sufficiently early, using a panel of UK firms, Dang (2011) develops a system of structural equations that models leverage, debt maturity and firm investment simultaneously. Although the obtained results do not support the hypothesis that firms can (or are willing to) proactively adjust debt maturity to reduce underinvestment issue, a highly robust *ex-post* negative impact from maturity to actual investment, a result similar to that of Aivazian et al. (2005b), is still found in high growth firms. There are two possible reasons. First, not all investment opportunities are observable. Second, even if all growth opportunities are foreseeable, cost of adjustments can also prevent firms freely adjusting their capital structures. In other words, the coefficient for maturity term in the investment regression should, at least partially, reflect the *ex-post* overhang effect generated by longer term debt, which may become more severe with unanticipated investment opportunities.

The recent financial crisis in 2008 offers an excellent experimental lab for testing the causal effect of capital structure related decisions on real behaviours conditioned on a

relatively exogenous credit shock. For example, using a difference-in-differences matching estimator method, Almeida et al. (2011) find that US firms with a large proportion of long-term debt maturing at the end of 2007 cut their investment much more than otherwise similar firms whose debt was scheduled to mature after 2008. Nevertheless, such a phenomenon is not observed during a period without credit contraction and also becomes insignificant for firms who do not relay on long-term debt as their major financing resource. Furthermore, using an extensive pan-European firm-bank matched data set, Kalemli-Ozcan et al. (2015) find that firms finance investment increasingly using more short-term debt in the run-up to crisis and expose themselves to rollover risk when the lending standards are tightened. Their results show that short-term debt does not curtail investment during normal times but turns into a heavy drag on investment during crisis times. The interpretation is that the sudden deterioration of the lending environment can substantially increase rollover risk for short-term debt and force firms with shorter maturity to reduce capital expenditures.

In conclusion, debt maturity structure affects debt overhang and the corresponding connection can be state-contingent. More specifically, shorter term debt should generate a larger negative impact on capital expenditure if firms face higher liquidity or rollover risks which can either be caused by deteriorating outside credit-supply conditions or distress in their own financial status. On the other hand, in normal times, shorter term debt may impose lower *ex-post* overhang effects since it is less sensitive to increased firm value from new investment and its flexibility can also offer a space for renegotiation between equity and debt holders. Therefore, firms in principle can trade off the cost of underinvestment problems against the cost of increased liquidity risk when choosing short debt maturity (Johnson, 2003). Nevertheless, due to costs of adjustment, the stickiness of debt level and its structure offers a possibility for testing the *ex-post* debt overhang effects on the actual investment expenditures.

4.3 CLFs preference for short-term debt financing

The common limitation in previous literature studying debt maturity structure is that the authors merely concentrate on firms in developed economics with a mature financial market in which firms relay on long-term debt as their major interest generating liability. For example, if we define debt maturity as the percentage of total debt that matures in more than one year, then the mean (median) value of this ratio is 0.72 (0.83) for US; 0.46 (0.47) for UK; 0.53 (0.57) for Germany and 0.59 (0.61) for France (Barclay and Smith, 1995; Antoniou et al., 2006). In these economies, short-term debt is probably just treated by non-financial firms as complementary to long-term debt. It is not surprising therefore that some studies using the US firms dataset even interpret the 'long-term' as the maturing period over at least 3 years (Custodio et al., 2013). Therefore, the impact from short-term debt usage on firms' real economic decisions may not be fully presented by previous empirical work. To fill this gap, in this chapter, we investigate the casual relation of firms' heavy reliance on short-term debt to their capital expenditures, by using the listed firm-level dataset from the Chinese economy where short-term debt is the dominating external credit resource for most local companies.

Cai et al. (2008) first notice the abnormally low ratio of long-term debt to total debt for Chinese (listed) firms, i.e. 0.23, compared to the firms in the above mentioned developed economies. There are several possible reasons for firms in China to depend on short-term debt financing. First, the Chinese economy has a bank dominating financial system, in which official lending activities are largely controlled by the credit supply from the banking sector. Therefore, the first choice of debt financing for Chinese firms is usually bank loan (Ayyagari et al., 2010). For instance, firms in the state sector relay on bank loans to raise more than 25% of their total financing needs (Allen et al., 2005). Measuring the size of the banking system as total debt credit to non-state sectors divided by GDP, over 2001–2007, the ratio is 116%, which is considerably larger than the average of other major emerging economies in the world, i.e. around 65% (Allen et al., 2008). It is common knowledge that banks prefer to lend short-term debt (Custodio et al., 2013).

Second, poor creditor protection, the low judicial and institutional efficiency can result in higher costs but fewer choices to long-term debt financing. Demirguc-Kunt and Maksimovic (1998) find that a greater proportion of firms use long-term external financing in countries with more efficient legal systems. This is because an effective legal system

can better protect the interest of creditors by deterring violations and enforcing compensation for infractions. Given low foreseeable recovery rates, creditors in China's capital market should naturally impose higher risk premium on a debt contract with longer maturity. Besides, China's corporate bond market is poorly developed and the major source of long-term debt available for most non-financial firms is still bank loan. Although banks have an advantage in minimizing costs of financial distress but face their own intermediation costs that are passed on to the borrower, so bank long-term debt is nominally more expensive than public long-term bond (Cantillo and Wright, 2000). To survive under such a financing environment, Chinese firms may proactively choose shorter term debt, thereby minimizing the interest costs.

Lastly, the weak legal protection of individual investors and the lack of enforcement of company laws may encourage managers to replace long-term debt by equity issuance (Chen, 2004). Specifically, Li et al. (2008) find that 52% of managers of CLFs in their surveyed sample think that costs of equity are lower than costs of debt. He (2012) also finds that the dividend pay-out ratio of CLFs is much lower than that of the firms in developed economies. Nevertheless, China's stock market has a complex regulatory system which makes common equity financing very inflexible.[76] Except for some basic legal rules, the listed firms also have to fulfil the regulations formulated by CSRC in order to obtain offering rights.[77] From 1993 to 2006, such regulations have been changed at least 5 times, indicating that the final decision rights of IPOs and SPOs are controlled by government hands.[78] Due to high policy restrictions, firms' equity issuing decisions may largely depend on whether or not they can fulfil the criterion to issue rather than their specific financial requirements. Therefore, considering the higher observable transactions costs and the long approving process of issuing new equity, CLFs may not be able to use equity issuance to replace long-term debt financing requirements instantly.

[76] Although the stock market is a symbol of capitalism, it was treated as an experiment by Deng Xiaoping, the paramount political leader at that time, who made an explicit pledge to close it down if this experiment turned out to be against the interests of the people. This was another important reason for the existence of the complex regulatory system, constrained IPOs and limited secondary public offering in China's stock market.
[77] China's Securities Regulatory Commission (CSRC) is an institution of the State Council of the People's Republic of China, with ministry-level rank. It is the main regulator of the securities industry in China.
[78] According to the regulations, firms are required to reach a certain level of performance, including historical profitability and dividend pay-out, for example. Nevertheless, it is sometimes difficult for CSRC to exactly judge the real situation of the firm.

4.4 Hypothesis development

Given the number of factors that result in the prevalence of heavy reliance on short-term debt financing among Chinese non-financial firms, the question arises about what the economic outcome of such an 'extreme' choice of short debt maturity could be. In this chapter, we provide answers with respect to firms' investment decisions as fixed capital accumulation is a significant determinant of economic growth in China over the past one to two decades (Ding and Knight, 2009; 2011). More specifically, we argue that firms with shorter debt maturity tend to invest less, since they face higher rollover risks. In terms of consequence, the debt overhang effect described in this chapter is similar to the underinvestment issue in Myers (1977). However, the working mechanism is somewhat different.

To begin with, we argue that the preference for Chinese listed firms (CLFs) to apply short debt maturity policy is mainly driven by the relative costs advantage as well as accessibility of short-term debt. The conventional ideas, i.e. owner-manager conflicts and signalling requirement, should present less explanatory power (Cai et al., 2008). In detail, some specific characteristics of corporate governance system in China, e.g. high ownership concentration and government nominated management, indicate that managers of CLFs have low incentives to work against shareholders (Jiang and Kim, 2015). Therefore, shareholders may have less incentive to discipline managers' behaviours by using more short-term debt to reduce free cash flow by forcing the firm to repay principals periodically. Furthermore, all studies exploring the effect of changes in credit supply at bank level on firm level outcomes recognize that bank-firm relation is likely to be stable (Greanstone et al., 2015 and Chodorow-Reich, 2014). A longer relation means more information filtered to banks (Farinha and Santos, 2002). In practice, bypassing information problems, most bank loans in China are backed by collateral, and the only type of collateral acceptable to many banks is land or buildings (Gregory and Tenev 2001 and Cousin 2006). Therefore, shorter maturity structure itself may not be treated as a signalling tool for CLFs to convey their qualities to banks.

Although the motivation behind short-term debt usage of Chinese firms is different from what has been suggested by conventional theories, it does not mean that these firms are also immune from the well-recognized disadvantage of relying on short-term debt, i.e. high rollover risk. Generally, cost of debt financing increases with credit risk which can be

amplified due to refinancing risk (He and Xiong, 2012). Empirically, Gopalan et al. (2014) show that the firms with greater exposure to rollover risk (measured by the amount of bond payable within one year) have lower credit quality and face higher yield spreads. Chiu et al. (2015) find that the rollover risk exposure also increases firm default probabilities. Wang et al. (2016) argue that the rollover risk effect is more significant in private debt markets since private debts are usually settled at shorter maturity than public traded debts. Using firm-bank syndicated loan data, their results indicate that firms using more short-term debt have to pay higher bank loan spreads. The implication of all this evidence is that creditors will require higher risk premium by more than that justified on default risk alone once they perceive a high level of borrowers' short-term repayment pressure. Therefore, in an economy where short-term bank loan is the major financing resource for firms, such as that of China, it is reasonable for us to conjecture that firms with shorter debt maturity tend to suffer more from the potential rollover risks, and hence are more likely to cut their near future capital expenditures due to either unfordable high costs for further borrowing or high existent repayment pressure.

Hypothesis I: *A Chinese firm with shorter debt maturity should present lower capital expenditure.*

The overhang costs generated by short-term debt are proved to be significantly larger at bad state, i.e. inside financial weakness or outside credit-supply contraction, since the rollover risks in these situations are much higher than in normal time. For example, when a firm's assets-in-place deteriorates, a short-term debtholder does not share as much risk as a long-term debtholder and this leads to more volatile earnings and equity value, and hence larger overhang costs (Diamond and He, 2014). Furthermore, Duchin et al. (2010) and Kalemli-Ozcan et al. (2015) find that firms having high short-term debt before the 2008 financial crisis presented more significant decline in investment after the crisis. The main reason is that lenders are often unwilling to renew expiring credit lines during economic downturn when collateral values drop. Even worse, Acharya et al. (2011) introduce a 'market freeze' phenomenon such that exorbitant rollover risk can result in a sudden collapse in the ability to borrow short-term debt against long-lived assets through the whole market even if fundamental value of collateral is at its highest level. To avoid sub-optimal liquidation, therefore, firms at bad state may extract more internal funds for debt repayment and reduce expenditures on capital.

As emphasized by Cull and Xu (2005) and Allen et al. (2008), Chinese banks are unwilling to lend secured loans unless they have high enough bargaining power as well as ability to seize collateralized assets upon default. Having such a dominating position in credit relation, it is very hard to believe that banks in China will play a very proactive role in relieving borrowers' financial strain. Additionally, unlike moveable assets, tangible assets are usually utilized in the daily production process of non-financial firms. If the new investment project is highly irreversible and requires a time relatively longer than expected to generate new cash flow, then the default losses caused by the sudden break in the financing chain can be devastating for equityholders, e.g. termination of production or even losing the whole future control rents. Therefore, in comparison to the firms listed in developed economies, in terms of debt refinancing, CLFs are more likely to suffer from deterioration in their own financial health or contraction in outside credit-supply.

Hypothesis II: *Shorter debt maturity should impose larger overhang effect on investment decision for the firms with bad financial health or when the credit-supply is contracted.*

Corporate financing decisions is likely to be different between SOEs and non-SOEs in China. Simply speaking, SOEs usually have better access to debt credits and are able to borrow more long-term bank loans than non-SOEs (Liu et al., 2011). Also, they are believed to have much lower default costs of debt (Fan et al., 2013). Therefore, it is reasonable to infer that SOEs on average face lower rollover risks than non-SOEs. The corresponding implication is that the underinvestment issue caused by shorter debt maturity is likely to be less severe for SOEs or the negative impact from shorter debt maturity on investment should be lower in SOEs than in non-SOEs. Nevertheless, several previous studies also find that SOEs tend to have worse financial performances than non-SOEs (Wei and Varela, 2003; Fan et al., 2007 and Li et al., 2008). The explicit or implicit government support may create a sort of soft budget constraint incentive problem which can reduce the efficiency of operating and investment decisions of SOEs. In the extreme situation, the direct government intervention can force SOEs to conduct political projects and to deviate from profit maximizing strategies. Either of these two issues can result in the worse financial condition of SOEs than that of non-SOEs which are more efficient and suffer less from direct government intervention. Based on the inference of our **Hypothesis II**, it is also reasonable to expect that SOEs present a negative short debt maturity-investment relation stronger than that of non-SOEs since SOEs are more likely to have

worse financial performances than non-SOEs[79]. Therefore, instead of proposing a specific hypothesis for the potential variation of the marginal impact from shorter debt maturity on investment decision between the firms with and without state ownership, we firstly generate the results and then see which logic is more plausible.

Finally, the stock market in China was initially established to finance those very largest SOEs who have close relations with government at either central or local level. After two to three decades of decentralization and privatization, a large proportion of shares in the stock market are still firmly grasped by governments' hands. In Figure C.4 in Appendix C, we can clearly see that the number of SOEs is much larger than the number of non-SOEs in the stock market from 1999 to 2010. Nevertheless, the number of non-SOEs is growing very fast during this period and it finally exceeds the number of SOEs at 2012. In Table 4.1, we can also see that on average almost 60% of firms are controlled by government. Therefore, the listed firms' dataset offers a considerably good laboratory to analyse the potential effect of government intervention on the debt-investment relation at firm-level.

4.5 Empirical specification

4.5.1 Baseline model

We apply a reduced form investment equation as our baseline model. The specification is very similar to, for example, that of Lang et al. (1996) and Aivazian et al. (2005b):

$$\frac{I_{i,t}}{K_{i.t-1}} = \alpha + \beta_1 Q_{i,t-1} + \beta_2 \frac{CF_{i,t}}{K_{i,t-1}} + \beta_3 Leverage_{i,t-1} + \beta_4 SDM_{i,t-1} + T_t + \mu_i + \varepsilon_{i,t} \quad (4.1)$$

where $I_{i,t}$ is fixed investment of firm i at time t; $K_{i.t-1}$ is lagged fixed assets; $Leverage_{i,t-1}$ is total financial debt divided by total assets; $CF_{i,t}$ is cash flow defined as earnings before interest, tax and depreciation; $SDM_{i,t-1}$ is our key variable measuring the level of short debt maturity and is defined as the financial debt maturing within one year (including one year) divided by total financial debt (Johnson, 2003 and Wang et al., 2016);

[79] For more details about (financial) performance of SOEs over the past one to two decades, please refer to Li et al. (2010) and Lardy (2014).

T_t is time dummy; μ_i is firm-level fixed effect; $\varepsilon_{i,t}$ is idiosyncratic error term. According to our **Hypothesis I**, β_4 should be **negative** and statistically significant. After controlling the level of leverage, the firms with shorter debt maturity invest less due to higher rollover risk.

4.5.2 Sample classification methods

To test our **Hypothesis II**, we have to firstly classify firms into different groups according to their own financial health. Refinancing risks of short-term debt are more likely to be triggered when firms are trapped in financial problems. The assumption behind this is quite realistic: a financially healthy firm should have higher repayment ability and lower default probability. In this chapter, we choose to rely on a firm's liquidity ratio and solvency as proxy for its financial status. Specifically, we define liquidity ratio as current assets divided by current liabilities. If a firm-year observation has a liquidity ratio larger than the sample median, then it is classified as in better financial state, otherwise in worse financial state. Also, solvency is defined as earnings before interests, tax and depreciation divided by total liabilities (Kalemli-Ozcan et al., 2015). A higher debt-to-earnings indicates a lower capacity to repay debt and that a larger fraction of earnings needs to be used to cover interest payments instead for new investments. The main reason to use the inverse of debt-to-earnings ratio, i.e. earnings to debt ratio, is that some observations present negative earnings. If a firm-year observation has a solvency ratio larger than the sample median, then it is classified as in good state, otherwise in bad state. We argue that higher liquidity or better solvency can attenuate the overhang costs generated by short-term debt through the channel of reducing rollover risks.

In addition, either liquidity ratio or solvency may not be able to fully reflect a firm's financial status. To consider such a possibility, we apply the Z-score developed by Altman (1968). This score is formulated by using the linear combination of working capital, retained earnings, cash flow, market value of equity and sales. It is initially used to predict bankruptcy and it is also used by recent studies to measure firms' financial performances, e.g. Denis and Sibilkov (2009). Similarly, the higher the Z-score is, the better the firm's financial status should be. Although Z-score can be a more comprehensive measurement, its limitation is also obvious. The relative weight allocated to each element in the function is calculated by using the dataset of bankrupt US firms from more than half a century ago. This sample driven characteristic of Z-score suggests that we need to treat it as a

complementary classification criterion to the liquidity ratio or the solvency which can be directly provided by using our own sample.

To do more robust sample separation tests, we further modify our classification methods. In detail, if a firm has at least 60% or no more than 40% observations marked as high or low liquidity, based on the criterion mentioned above, then this entire firm is regarded as having higher or lower probability of staying at good or bad financial status, respectively, during the sample period. The same procedure is repeated when we use solvency and Z-score as measurements of firms' financial status. Finally, we estimate equation (4.1) by using the data of firms in the 'good' or 'bad' group and comparing the coefficient on SDM between the two groups. If our **Hypothesis II** is correct, then we should see that the absolute value of coefficient β_4 is larger in the 'bad' group than in the 'good' group. What is noteworthy is that our indicator is time-invariant and it is constructed by using a method similar to that utilized by Guariglia (1999). Although financial variables are very time persistent (Lemmon et al., 2008), it is still possible for firms to shift their financial status during the sample period. Therefore, in the robustness test, we create an interaction term between financial health measurements and short debt maturity in equation (4.1). If our **Hypothesis II** is correct, then we should see that the coefficient on the interaction term is positive and statistically significant.

In terms of the 2008 financial crisis effects, we separately estimate equation (4.1) by using the data before and after the year 2008. It is also necessary for us to consider the potential entry effect, since we find that entrance is much more frequent than delisting in China's stock market. A newly listed firm may enjoy equity financing and be less dependent on debt financing. Therefore, we will firstly use the full sample and then repeat the financial crisis analysis by only using the data of firms listed before 2008. The major reason for us to use a year dummy to identify the presence of financial crisis effect is that the outside financing environment should change dramatically during that period of time. According to the western literature, either public or bank credit-supply in US and European markets shrank dramatically over the crisis period (e.g. Ivashina and Scharfstein, 2010; Cornett et al., 2011; Popov and Udell, 2012). This can substantially increase the rollover risks faced by firms in those economies. Nevertheless, the situation is absolutely different in China.

At the end of 2008, the Chinese central government released an unprecedented 4 trillion RMB fiscal stimulus (12.6% GDP in 2008) valid in 2009 and 2010. There are several features of this stimulus plan. First, due to the public-goods nature of the infrastructure-investment-centric stimulus package, it is local governments that carried out the credit expansion through their own 'financing vehicles' with 90% spending funded by bank loans (Bai et al., 2016). Second, the debt expansion is highly asymmetric. SOEs and publicly listed firms proved to be more favoured by not only the stimulus plan but also the corresponding monetary expansionary policies (Huang et al., 2016). Lastly, although the stimulus plan helped bolster the slumping Chinese economy, it caused some unintended consequences which may have damaged long-term economic growth, e.g. shadow banking (Chen et al., 2017) and deeper credit misallocation (Cong et al., 2017). These facts indicate that CLFs were able to enjoy a strong credit expansion rather than contraction after 2008 financial crisis, in terms of bank financing. Also, compared to the pre-crisis period, the rollover risks should have suddenly become lower. Besides, such expansion is unlikely to be quickly digested and its effects are ongoing even some years after 2010 (Cong et al., 2017). Therefore, using the CLFs dataset, if we separate the sample by using year 2008 as the 'watershed', then we shall see that the absolute value of coefficient β_4 is smaller in the period after the crisis than in the period prior.

Finally, we use the nature of a firm's ultimate controller to define its ownership type (Chen et al., 2009). More specifically, if a firm-year observation shows that the nature of its ultimate controller is the state or a non-state investor, then the firm at this year is regarded as an SOE or a non-SOE, respectively. Although this variable is time invariant for most firms in our dataset, there are still some firms with ultimate shareholders who have changed from the state to other types of investors due to continued privatization. Therefore, we first classify firms into a 'State' or 'non-State' group and then eliminate the firms that have changed their ownership status during the sample period.

4.5.3 Endogenous issue and Estimation method

There are potential endogenous resources in equation (4.1). Our major hypothesis does not exclude the possibility that the underinvestment incentives generated by short-term debt could be mitigated by the firm's financing through more long-term debt or by lowering the overall leverage level, if future growth opportunities are recognized sufficiently early when the firm has outstanding debt. Nevertheless, this argument has its

own limitations. First, not all investment opportunities can be anticipated. Second, capital structure adjustments are costly. For instance, the unanticipated growth opportunities will leave less scope for attenuating underinvestment problems. Renegotiations with debtholders have to be taken quickly before the unanticipated growth opportunities dissipate in a competitive market. Time constrained renegotiations will be more costly in comparison to when growth is anticipated, since either buying back a substantial amount of debt or restructuring the composition of external capital within a short time period can result in high transaction/ adjustment costs. In the extreme case, even if all growth opportunities are anticipated, various costs associated with adjustment can still be large enough to prevent firms fully resolving the underinvestment problem. Therefore, the stickiness of debt level and its structure may offer a possibility for testing the *ex-post* overhang effects on the actual investment expenditures, even without controlling the potential effects from endogeneity.

Nevertheless, in the empirical tests, it is highly possible that investment opportunities cannot be effectively captured by Tobin's Q. For example, Chinese stock prices have proved to be likely to deviate from the corporate fundamental values due to political actions (Bondt et al., 2015). If we assume that leverage decision is correlated with investment opportunities which cannot be completely controlled in the regression or if we believe that there are some common factors that affect leverage and investment opportunities but are omitted from the investment model, then both OLS and fixed effects estimators tend to generate biased coefficients on leverage and short debt maturity terms in equation (4.1). To solve such potential endogeneity issues, we follow Aivazian et al. (2005b) and estimate our investment models by using the first-differenced GMM developed by Arellano and Bond (1991). This method takes first differences of all elements in equation (4.1) to eliminate the individual effect μ_i and then utilities all the lagged values of the regressor as instruments.

4.6 Data and Stylised facts

In this chapter, we use the annual firm-level dataset drawn from the China Stock Market & Accounting Research (CSMAR) database from 1998 to 2016, covering all active firms listed in the Shanghai and Shenzhen Stock Exchanges. We use the following methods to

clean the original dataset. First, financial firms and utility firms are excluded. Second, we exclude the firm-year observations with zero total financial debt. This is because debt maturity is calculated as the ratio of short-term debt to total financial debt. If the value of total financial debt is equal to zero, then the short debt maturity will be a missing value. Besides, the firm-year observations with financial leverage values larger than 1 or smaller than 0 are excluded. After that, all variables presented in equation (4.1) are winsorized at 1th and 99th percentiles.[80] Lastly, firms with less than 5 consecutive observations are excluded. The final sample contains 1,769 firms with 19,970 observations. The processed dataset is unbalanced, and the average number of observations for firms is 11.3 years.

4.6.1 Descriptive statistics

Table 4.1 provides descriptive information on the variables used in equation (4.1). We can see that the mean value of investment rate of CLFs is 0.27 and it is much larger than the ratio obtained by past literature using the US firms dataset, e.g. 0.08 in Aviazian (2005) and 0.05 in Almeida et al. (2011). This is consistent with the fact that fixed asset investment accounts for about 50% of GDP growth in China. The sample average Tobin's Q is 1.71, which reflects market expectations of strong growth opportunities for CLFs over our sample period. The mean cash flow ratio is 0.49, which reflects a relatively high availability of internal funds for investment. The average leverage level is 0.23 which is lower than the 0.27 for US firms, see Custodio et al. (2013). The mean proportion of the short-term debt to total debt is 72%, indicating that CLFs on average hold much more short-term debt than long-term debt. At the bottom of Table 4.1, we report the ratio of short/ long – term debt to total assets. For CLFs, the average short-term debt ratio is 0.16 and the average long-term debt ratio is 0.07. Nevertheless, Welch (2011) emphasizes that non-interest generating liabilities cannot be treated as equity and should be controlled when evaluating a firm's indebtedness level. Therefore, we further report the ratio of short/ long – term debt to total shareholder's equity. The average value of the ratio of short-term debt to total shareholder's equity is equal to 0.31. This suggests that short-term debt should be a non-trivial component of CLFs' capital structure.

The possible high correlation among the variables in equation (4.1) can be an issue in the estimation process. For example, past studies show that the firms with high growth

[80] All variables are deflated back to year 2000 by using annual CIP deflator. The only exception is the fixed capital which is deflated by using the index specific to fixed assets. The index can be found on the National Bureau of Statistics of the PRC.

opportunities tend to reduce their leverage as well as their debt maturity (Barclay and Smith, 1995). This may lead to serious multicollinearity among Tobin's Q, leverage, and the short debt maturity variables. Also, in the trade-off theory, the firms with higher cash flow ratio may also have higher leverage level and longer debt maturity. Therefore, in Table 4.2, we report the correlation matrix among all the regression variables. The results show that the correlation coefficients are not high and hence multicollinearity should not be a serious issue.

Table 4.1: Statistic description

Variable names	Mean	Sdt. Dev.	Minimum	Median	Maximum
$I_{i,t}/K_{i.t-1}$	0.277	0.369	-0.113	0.151	1.379
$Q_{i,t-1}$	1.712	1.387	0.191	1.302	7.629
$CF_{i,t}/K_{i,t-1}$	0.496	0.818	-0.906	0.322	9.868
$Leverage_{i,t-1}$	0.232	0.138	0.001	0.234	0.999
$SDM_{i,t-1}$	0.721	0.309	0	0.838	1
State ownership	59.18%	49.15%	0	1	1
Long-term debt/total assets	0.069	0.092	0	0.031	0.845
Short-term debt/total assets	0.162	0.124	0	0.142	0.999
Long-term debt/total equity	0.151	0.212	0	0.055	0.999
Short-term debt/total equity	0.309	0.253	0	0.251	0.999

Definitions of all variables are available in Appendix C.

Table 4.2: Correlation table among regression variables

	$I_{i,t}/K_{i.t-1}$	$Q_{i,t-1}$	$CF_{i,t}/K_{i,t-1}$	$Leverage_{i,t-1}$	$SDM_{i,t-1}$
$I_{i,t}/K_{i.t-1}$	1.000				
$Q_{i,t-1}$	0.040	1.000			
$CF_{i,t}/K_{i,t-1}$	0.271	0.087	1.000		
$Leverage_{i,t-1}$	**-0.045**	**-0.259**	-0.086	1.000	
$SDM_{i,t-1}$	**-0.050**	**0.158**	-0.114	-0.096	1.000

The distribution of short debt maturity is presented in Figure 4.1. The chosen cut-off percentages of short debt maturity reflect the percentiles at 25th (51%), 50th (83%) and 75th (100%). More specifically, around 75% of firm-year observations show a proportion of short-term debt usage larger than 51% of total debt usage and almost 30% of firm-year observations only have short-debt term debt as their interest generating liabilities. The corresponding mean value of book financial leverage for firm-year observations in each short debt maturity category is also plotted in Figure 4.2. Surprisingly, on average, the firms with short debt maturities larger than zero but smaller than one tend to have similar leverage levels, slightly over 0.25, regardless of how they are classified in lower or higher maturity percentiles. For the firms with solely short-term or long-term debt, their averaged

leverage ratios are 0.12 and 0.16 respectively, which are significantly smaller than those of the firms in other categories. These facts provide two useful suggestions for our regression analysis. First, although CLFs have generally high short debt maturity levels, the variations of choices between short-term and long-term debts are still substantial among firms. This should allow us to more confidently pin down the relation from short debt maturity to capital expenditure. Second, for the majority of sampled firms, the information contained in maturity and leverage levels is unlikely to overlap. For example, the short debt maturity term itself should convey information about the degree of rollover risk while leverage may indicate debt capacity.

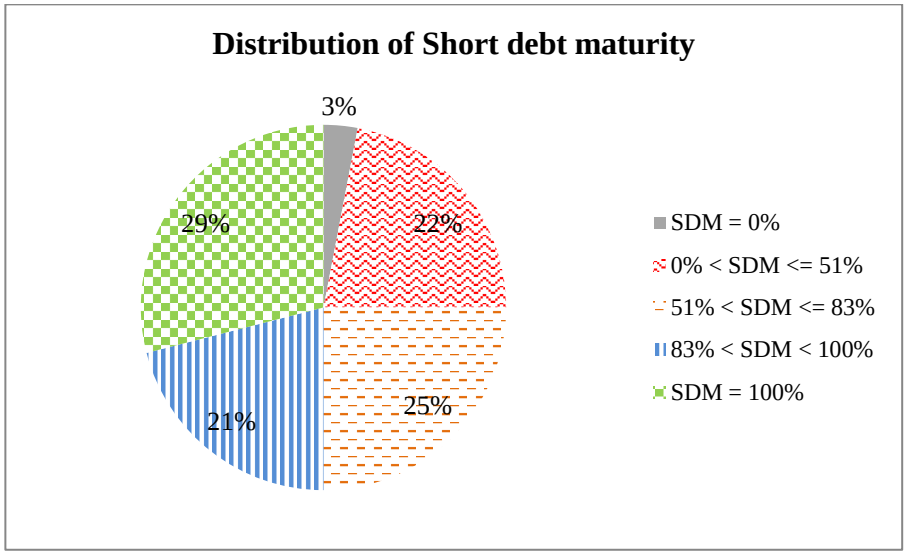

Figure 4.1: Distribution of short debt maturity

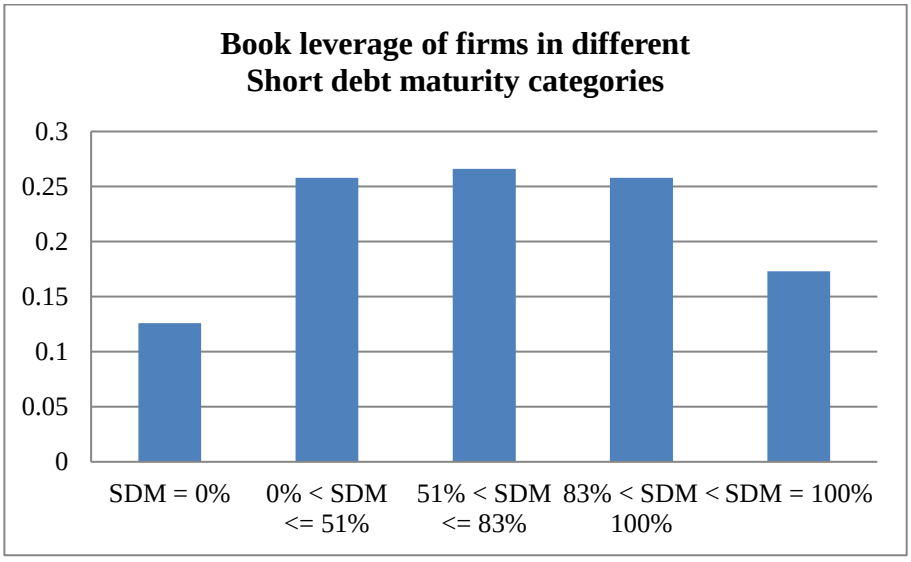

Figure 4.2: Averaged leverage in each maturity group

In Figure 4.3, we plot the annual median value of fixed investment rate and the annual median value of short debt maturity over our sample period. First, there is a sudden collapse in short debt maturity after 2008 (0.87) followed by a slight rebound in 2011 (0.82) but a continuous drop until the end of the sample period in 2016 (0.68). Second, investment rate declines gradually before the 2008 financial crisis and almost reaches the sample bottom in 2008 (0.08) but it immediately jumps up to our sample peak in 2009 (0.27) followed by a breakneck drop in 2010 reaching the actual sample bottom at 0.078. After that, investment rate recovers very quickly and reaches the second sample peak at 0.24 in 2012 but returns to the normal level in the following years, i.e. around 0.15, which is somewhat higher than the investment rate in the pre-crisis period. The high volatile investment and financing behaviours of CLFs after the 2008 financial crisis should reflect the implementation of the 4 trillion RMB fiscal stimulus plan. Also, our data show that the average proportion of long-term debt to total debt of CLFs increases substantially after 2008. This is consistent with the finding obtained by Cong et al. (2017) who use a much broader manufacturing dataset in China. Overall, the general rollover risk in China should have reduced during the credit expansion period. Nevertheless, such fiscal stimulus may still increase the future rollover risks which can in turn constrain long-term economic growth (Chen et al., 2017).[81]

Lastly, in section 4.3 of this chapter, we argue that short-term debt plays an important role in fulfilling the financial requirements of Chinese listed firms. We can explore this issue through two aspects. First, in Tables 4.3 and 4.4, we compare the actual issuances of short-term debt, long-term debt and equity. The changes of all securities are calculated by using balance sheet information and are normalized by using the beginning period of total assets. If a firm makes issuance of one sort of security for at least 5% of last period's total assets, then we define it as one financing spike.[82] In Table 4.3, the percentage of the number of large adjustments to total observation is 27%, 18% and 12% for short-term debt, long-term debt and equity issuances, respectively. The average number of adjustments per firm over our sample period is 2.78, 1.87 and 1.19 for short-term debt, long-term debt and equity issuances, respectively. These results suggest that CLFs are more likely to make large proactive capital structure changes through short-term debt issuance. However, this

[81] A complete discussion to the causes and consequences of such stimulus plan is out of the scope of this paper. See Bai et al. (2016), Cong et al. (2017) and Chen et al. (2017) for more details.
[82] Similar analyses can be found in Leary and Roberts (2005) for US firm-level dataset.

may only reflect the frequent rollover requirement of short-term debt rather than the short-term debt preference of firms.

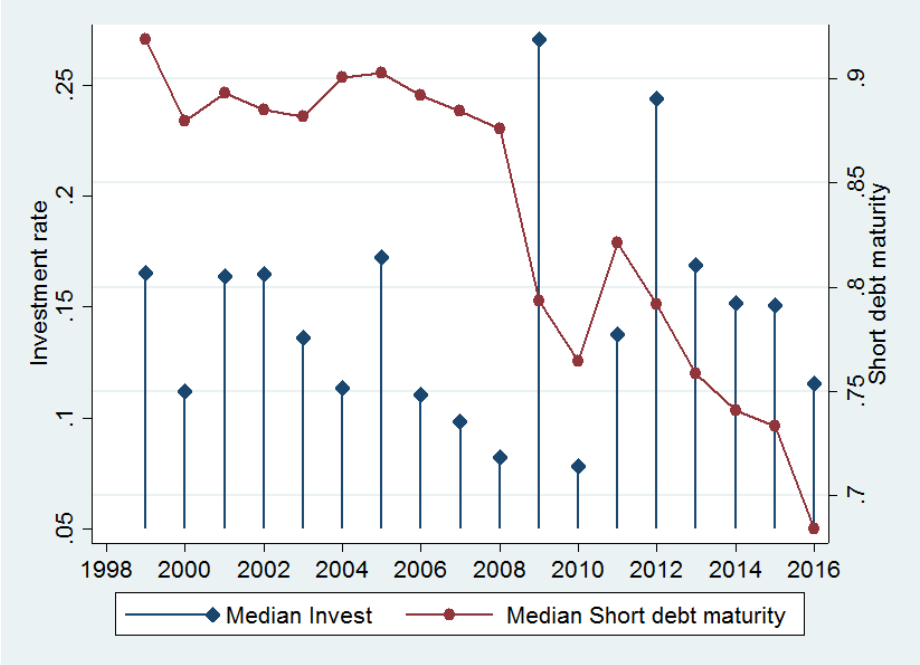

Figure 4.3: Time variation of Investment and short debt maturity

Table 4.3: Large security issuance

	Number of adjustments	Percent of periods	Adjustments per Firms			
			Mean	Min	Median	Max
Short debt issue	4916	27.01%	2.78	0	2	12
Long debt issue	3314	18.21%	1.87	0	1	11
Equity issue	2019	11.59%	1.19	0	1	11

Short debt issuance is calculated as changes of short-term debt divided by lagged total assets. **Long debt issuance** is calculated as changes of long-term debt divided by lagged total assets. **Equity issuance** is calculated as the cash received from the issuance of stocks net of commission and other issuance fees divided by lagged total assets. If the security issuance is larger (not less than) 5% of lagged total assets, then it is regarded as refinancing spike, i.e. large adjustment. This treatment also helps to separate firms' real financial requirements from other trivial changes of capital structures. **Number of adjustments** is number of observations defined as refinancing spike. Percent of periods is the ratio of number of adjustments to (total observations - total number of firms), since we use lagged total assets in the calculation of all issuances.

Therefore, in Table 4.4, we report summary statistics on the magnitude of the different types of issuances larger than zero.[83] We focus on the results of medians because of the large skew in each measure's distribution. The median size of positive short-term debt issuance is 483 million in RMB, which is much larger than that of positive long-term debt

[83] All variables are deflated back to year 2000 using CPI index.

issuance (345 million in RMB) and positive equity issuance (246 million in RMB). Besides, after normalizing these numbers by firms' total assets, we can see that short-debt issuance occupies 4.4% of total assets, which is slightly higher than the 4.1% of long-debt issuance and much higher than the 0.6% of equity issuance.[84] On average, although the ratio of short-term debt issuance to total asset is similar to the ratio of long-term debt issuance to total asset, we must keep in mind that the number of observations presenting positive short-term issuance is obviously larger than the number of observations presenting positive long-term issuance. The difference is around 14% of the total number of observations. In terms of equity issuance, either its magnitude or relative value to assets is much smaller than that of debt issuance. Therefore, at least, our statistical descriptions do not support the conventional idea that CLFs can on average replace long-term debt financing with equity issuance.[85]

Table 4.4: Size of security issuance

		Median	Mean	Std.	Obs.
Short debt issue	Size in RMB	48.3	148	491	9133
	Divided by total assets	0.044	0.070	0.083	9133
Long debt issue	Size in RMB	34.5	282	1360	6631
	Divided by total assets	0.041	0.072	0.095	6631
Equity issue	Size in RMB	2.46	39.9	183	7476
	Divided by total assets	0.006	0.063	0.128	7476

The unit of size in RMB is 10 million. This table only reports the size of positive issuance. Definitions of all other variables can be found in bottom of Table 4.3.

Another deeper question is how CLFs finance their investment. Firms can support their positive growth opportunities by using either cash flow, cash holdings, short/ long – term debt and even new equity or arbitrary combinations of these options. If short-term debt is indeed important in determining firms' real decisions, then it should at least be a major resource for financing those decisions. To check this intuition, we use the framework provided by Gatchev et al. (2009). The general logic is that financing decisions in practice are related to each other by accounting identities. Firms are constrained by the fact that sources of cash must equal uses of cash. Adjusting any one policy variable will result in adjustment of other policy variables. Therefore, we should examine corporate financial decisions in a constrained multivariate setting. In Appendix C of this chapter, we list the group of equations (C.2) used to describe such a concept. More specifically, in the system, there are four sub-equations referring to changes of cash balance, short-term debt issuance,

[84] Total assets here are all lagged by one year.
[85] However, we do not exclude the possibility that Chinese listed firms were indeed able to replace long-term debt financing very easily through equity issuance in years past, e.g. before and around year 2000.

long-term debt issuance and equity issuance, respectively.[86] The coefficient constraints settings are also provided in Appendix C. The four sub-equations are estimated simultaneously and the results are reported in Table A.16 in Appendix C. Our interpretations focus on the coefficients on working capital investment and fixed capital investment. First, 0.34, 0.25 and 0.17 of one unit increase in working capital financing requirements will be supported by short-term debt, long-term debt and equity, respectively. Second, 0.42, 0.28 and 0.13 of one unit increase in fixed capital financing requirements will be supported by short-term debt, long-term debt and equity, respectively. The differences among these coefficients are highly statistically significant. Overall, at this stage, it should be reasonable to conclude that short-term debt on average plays a more important role in supporting the financial requirements of CLFs than long-term debt and equity. This indicates that rollover risk should be a common problem faced by these firms.

4.6.2 Univariate analyses

Table 4.5 contains the results for the univariate tests to **Hypothesis I**. We classify all firm-year observations into five different categories according to their short debt maturity (SDM) levels: Zero (SDM=0); Low (0<SDM<=25th %tile); Median (25th %tile <SDM<=50th %tile); High SDM (50th %tile<SDM<1) and One (SDM=1). Then, from Zero SDM group to One SDM group, we list the mean value of investment rate in each group. There is a clear declining tendency of investment rate from Low SDM group (0.29) to High SDM (0.23). In the bottom of the table, we have also presented the F-test results for the null hypothesis that the (positive) difference in investment rates between any two adjacent groups is statistically insignificant. The P-values show that the investment rates are highly statistically different from Low SDM group to Med SDM group and from Med SDM group to High SDM group. Besides, the averaged investment rates are 0.27 and 0.24 respectively for the group of firms with zero and unit values of SDM. Although there are no significant declines in investment from Zero SDM group to Low SDM group and from High SDM group to One SDM group, the firms in Zero (One) SDM group still present strictly higher (lower) investments than the firms in Med, High (Low) and One (Zero) SDM groups. From the overall perspective, therefore, these results are consistent with the description in our **Hypothesis I**.

[86] Strictly speaking, there should also be a fifth equation: share repurchase. However, share repurchase in China's stock market is extremely rare. Adding it does not change anything in our results. Therefore, we eliminate it from the equation group.

Table 4.6 contains the results for the univariate tests to **Hypothesis II**. We firstly classify firm-year observations into High SDM and Low SDM using the sample median value of short debt maturity as the threshold. Second, we further separate observations in either High SDM or Low SDM into good/ bad financial state: i.e. High/ Low liquidity group; High/ Low solvency group and High/ Low Z-score group, respectively. After that, within either good or bad state, we compare the averaged investment rates between High SDM and Low SDM. The P-values generated by F-test show that all differences are highly statistically significant, indicating that firms with shorter debt maturity tend to invest less in either good or bad state. Nevertheless, such difference in investment rate is likely to be much larger for firms in bad state than in good state and this phenomenon is consistent across all measurements of firms' financial status. For example, fixing the liquidity at low (high) level, the firms with High SDM have an average investment rate 9% (3%) lower than the firms with Low SDM. These preliminary results indeed support our **Hypothesis II**.

Table 4.5: Univariate analysis (Hypothesis I)

	Zero SDM	Low SDM	Med SDM	High SDM	One SDM
$I_{i,t}/K_{i.t-1}$ (Mean)	0.276	0.295	0.257	0.236	0.244
Diff (Zero - Low)	-0.019				
P-value	0.277				
Diff (Low - Med)		**0.038*****			
P-value		0.000			
Diff (Med - High)			**0.021*****		
P-value			0.003		
Diff (High - One)				-0.008	
P-value				0.300	
Observation	494	3975	4493	3960	5279

All firm-year observations are classified into five different categories according to their short debt maturity (SDM) levels: Zero (SDM=0); Low (0<SDM<=25th %tile); Median (25th %tile <SDM<=50th %tile); High SDM (50th %tile<SDM<1) and One (SDM=1). The mean value of $I_{i,t}/K_{i.t-1}$ for each group is presented. The difference between any two adjacent groups is calculated. The P-values for the t-test under the null that the difference is statistically insignificant are reported. *, ** and *** denote statistical significance at 10%, 5% and 1% conventional levels, respectively. Definitions of all variables are available in Appendix C.

In Table 4.6, we also classify the observations in each SDM category into 'Before' and 'After' 2008 financial crisis. Clearly, during the credit expansion period, i.e. after 2008, the SDM imposes much lower negative impact on the investment rate of firms than in the normal time, i.e. before 2009. This requires us to clarify the implication of our **Hypothesis II**. In the hypothesis, firms are more likely to suffer from shorter debt maturity during the credit-supply contraction period. The financial crisis in 2008 should provide a chance to

identify such a relation. Nevertheless, due to the 4 trillion stimulus plan, our focus turns from the expected credit contraction into the unexpected credit expansion. In other words, compared with the after crisis period in China, the credit-supply should be much more tight before the crisis. Instead of repeating the depression story which has already been widely detected by western literature, we provide new empirical evidence for the debt-investment relation under the credit boom environment.

Table 4.6: Univariate analysis (Hypothesis II)

	High SDM	Low SDM	Difference	P-value
High Liquidity	0.273	0.301	-0.028***	0.000
Low Liquidity	0.237	0.324	**-0.087****	0.000
High Solvency	0.271	0.317	-0.046***	0.000
Low Solvency	0.237	0.307	**-0.069****	0.000
High Z-score	0.276	0.322	-0.046***	0.000
Low Z-score	0.226	0.304	**-0.078****	0.000
Before 2008 Crisis	0.237	0.329	-0.091***	0.000
After 2008 Crisis	0.272	0.301	**-0.029****	0.000
SOEs	0.300	0.226	**-0.074*** **	0.000
Non-SOEs	0.289	0.331	-0.042***	0.000

If a firm-year observation has SDM value larger (smaller) than the sample median value of SDM among all observations, then this observation is classified as High SDM (Low SDM). If a firm-year observation has liquidity ratio higher (lower) than the sample median value of this variable, then this observation is classified as High Liquidity (Low liquidity). We create other groups in the same way: i.e. High Solvency, Low Solvency, High Z-score and Low Z-score. If a firm-year observation presents before year 2009, then it is classified as Before 2008 crisis. If a firm-year observation presents after year 2008, then it is classified as After 2008 crisis. **The mean value of investment rate is calculated for each sub-category**, e.g. the firms in High Liquidity – High SDM group have an averaged investment rate equal to 0.27. For either high or low financial health group, we calculate the difference in the mean values of investment rates between High SDM group and Low SDM group. The P-values for the t-test under the null that the difference is statistically insignificant are reported. *, ** and *** denote statistical significance at 10%, 5% and 1% conventional levels, respectively. Definitions of all variables are available in Appendix C.

Lastly, at the bottom of Table 4.6, we further classify observations into 'SOEs' and 'non-SOEs'. The average fixed investment rate declines much more from 'Low SDM' group to 'High SDM' in SOEs than in non-SOEs. This result may support the argument that SOEs present lower financial health and are more likely to suffer from rollover risks than non-SOEs. In Table A.17 in Appendix C, we compare the values of three financial health indicators between SOEs and non-SOEs. Nevertheless, the results are mixed to some extent. Specifically, SOEs indeed present lower values of liquidity and Z-score than non-SOEs but also have significantly higher solvency than non-SOEs. Besides, such univariate test results may suffer from an endogeneity issue. For example, the budgets of

non-SOEs are more constrained than that of SOEs. Therefore, non-SOEs should be more active in controlling their rollover risks, thereby reducing the potential underinvestment issue caused by shorter debt maturity. Besides, in unreported results, we also find that the non-SOEs with higher shorter debt maturity have much higher investment opportunities than the SOEs with higher shorter debt maturity. In other words, that SOEs in 'High SDM' group invest less may simply be because they have low investment opportunities. These potential problems require us to draw our conclusion about ownership effect by relying on the regression results rather than the univariate test results.

4.7 Regression Results

4.7.1 Investment and short debt maturity

The baseline results of the estimated investment equation (4.1), using the full sample, are reported in Table 4.7. Columns (1), (2) and (3) report OLS, fixed effects and first-differenced GMM (FD-GMM) estimators, respectively. First, the coefficient on short debt maturity (SDM) term is negative and highly statistically significant, across all three different estimators. This is consistent with the predication in our **Hypothesis I** that the firms with shorter debt maturity tend to suffer more from rollover risk and hence invest less. According to the FD-GMM estimator, for example, the results show that a 10% increase in sample average value of SDM will lead to a reduction in fixed investment by 0.03, i.e. around 11% of sample average investment value.[87] Therefore, the effect of SDM on investment is not only statistically significant but also economically important. Furthermore, the coefficients on all other independent variables have expected signs. The investment opportunity measurement, Tobin's Q, has a positive and statistically significant coefficient. Besides, higher cash flow is associated with higher investment while higher leverage ratio leads to lower investment. These results are consistent with those of previous studies about the investment-cash flow sensitivity (e.g. Fazzari et al., 1988 and Gilchrist and Himmelberg, 1995) and of leverage-investment relation (Lang et al., 1996 and Aivazian et al., 2005).

[87] The sample averaged value of lagged SDM is 0.72. A 10% increase in SDM is equal to 0.72*0.1 = 0.072. This will lead to reduction in fixed investment by 0.072*(-0.42) = 0.03. The sample averaged value of investment is equal to 0.27. Therefore, 0.03/0.27 = 0.108, i.e. around 11%.

Lastly, while the FD-GMM results are qualitatively similar to those of OLS and FE, one finding of note is that the magnitudes of the coefficients on both leverage and short debt maturity terms are significantly larger than the magnitudes of the corresponding coefficients in OLS and FE. One possible explanation is that the coefficients generated by OLS and FE estimators capture managers' unobservable expectation about debt overhang which can affect their investment decisions and capital structure related decisions simultaneously. In other words, the actual negative impacts from leverage as well as short debt maturity may have been 'attenuated' by OLS and FE estimators.[88] Nevertheless, the absolute value of coefficient on SDM changes dramatically from 0.039 in the OLS estimator to 0.43 in the FD-GMM estimator. This huge gap in magnitude makes us anxious about the reliability of the results generated by both estimators.

Therefore, in columns (4) and (5) of Table 4.7, we provide the results generated by System GMM and IV estimators respectively. The System GMM (SYS-GMM) results present a seemingly more normal absolute value of coefficient on SDM equal to 0.20. Nevertheless, they also produce a P-value of Hansen test at 0.000, indicating that the twice lagged first-differenced independent variables may not be valid additional instruments. More surprisingly, the IV estimators show a coefficient on SDM with an absolute value equal to 1.88 which is almost 50 times larger than that of the OLS coefficient. This embarrassing situation is a regular finding in the finance and growth literature (e.g., Molina, 2005; Laeven and Levine, 2007; Barth et al., 2009).[89] Using Chinese listed firms' dataset over 1991-2004, Firth et al. (2008) study the relation between total investment and leverage ratio and obtain an IV coefficient on leverage term 10 times larger than the fixed effects coefficient. This is a common feature of their results throughout their whole paper. More specifically, in our IV approach, we follow Firth et al. (2008) and use tangibility as an instrument for leverage.[90] We follow Gopalan et al. (2011) and use asset maturity together with current assets ratio as instruments for SDM.[91] All instruments are lagged one to two years. At the bottom of column (5) of Table 4.7, we can see that the P-value

[88] For instance, managers can reduce leverage or short-term usage in the anticipation of future investment opportunities. Then, the observed values of leverage and short debt maturity are *ex-post* outcomes of such forward decisions. If most of firms can follow this strategy, then the magnitude of coefficient on short debt maturity term in the investment regression will be reduced. In other words, the actual impact of capital structure related decisions on investment decision is hidden by such an endogenous problem. What we have seen is that OLS results are biased towards the sample of firms who were unable to adjust their capital structures before the investment decisions were taken. Lastly, determinants of managers' expectation can be time variant. Therefore, fixed effects estimators still suffer from a serious endogenous issue.

[89] Jiang (2017) provides more detailed study of this "implausibly large" IV estimate in finance research.

[90] Tangibility is defined as fixed assets divided by total assets.

[91] Asset maturity is defined as fixed assets divided by depreciation. Current asset ratio is defined as total current assets divided by total assets.

generated by the under-identification test shows that the null hypothesis, that our model is insufficiently identified, can be rejected at 1% significant level. Also, the F statistic shows that a weak instrument should not be a big problem in our IV approach. Nevertheless, the Hansen test is still rejected at 1% significant level, indicating that there is potential correlation between our chosen instrument sets and the error term.

Table 4.7: Baseline model (Hypothesis I)

Dependent: $I_{i,t}/K_{i.t-1}$	OLS (1)	FE (2)	FD-GMM (3)	SYS-GMM (4)	IV (5)
$Q_{i,t-1}$	0.014***	0.017***	0.024***	0.013**	0.048***
	(0.002)	(0.003)	(0.006)	(0.006)	(0.014)
$CF_{i,t}/K_{i,t-1}$	0.075***	0.105***	0.111***	0.123***	0.075***
	(0.002)	(0.003)	(0.019)	(0.014)	(0.008)
$Leverage_{i,t-1}$	-0.029	-0.072***	-0.716***	-0.236***	-4.221***
	(0.019)	(0.027)	(0.167)	(0.089)	(0.615)
$SDM_{i,t-1}$	**-0.039****	**-0.063****	**-0.426****	**-0.204****	**-1.881****
	(0.008)	(0.012)	(0.095)	(0.045)	(0.227)
constant	0.236***			0.305***	
	(0.017)			(0.045)	
Year dummies	Y	Y	Y	Y	Y
AR(2) test (p-value)			0.723	0.423	
Hansen test (p-value)			0.135	0.000***	0.000***
UnderID-test (p-value)					0.000***
WeakIV-test					16.415
Firms		1769	1769	1769	1769
Observations	18201	18201	16432	18201	16430

In column (1), OLS estimators are reported. In column (2), Fixed effects estimators are reported. In column (3), first-differenced GMM estimators are reported. Equation (4.1) is first-differenced and all independent variables are lagged twice and more as instruments. In column (4), system GMM estimators are reported. In this case, all independent variables in the first-differenced equation (4.1) are instrumented by their twice and more lagged values. For equation (4.1) in level, additional instruments are differenced values of independent variable lagged twice. P-values of AR(2) test and Hansen test are reported. In column (5), the instrumental variable estimators are reported. Leverage is instrumented by tangibility defined as the ratio of fixed capital to total assets. Short debt maturity is instrumented by asset maturity defined as fixed capital divided by depreciation and the ratio of current assets to total assets. All 3 instrumental variables are lagged once and twice. **UnderID-test:** The p-value is calculated for the under-identification test, given the null hypothesis that the equation is not well identified. **WeakIV-test:** The Kleibergen-Paap rk Wald F statistic is also reported for the Stock-Yogo weak identification test. The corresponding critical values: 5%, 10%, 20% maximal instrumental variable relative bias is equal to 15.72, 9.48 and 6.08 respectively. Standard errors are reported in brackets. *, ** and *** denote statistical significance at 10%, 5% and 1% conventional levels, respectively. Definitions of all variables are available in Appendix C.

In summary, if we believe that our treatment of possible endogenous effects may over 'pump up' the coefficient on SDM towards a negative direction for some reason, then we can say that this problem should be more serious in the IV approach. If we believe that the Hansen test is important for evaluating the performance of instrument sets, then both the SYS-GMM and IV approach are likely to provide problematic results. Overall, comparing across the results generated by the FD-GMM, SYS-GMM and IV approach, it is probably

still more appropriate for us to rely on the results generated by the FD-GMM. There are two obvious reasons. First, the FD-GMM coefficients are larger than SYS-GMM coefficients but much smaller than IV coefficients. Second, both the P-values of the AR(2) test and Hansen test in our FD-GMM results are larger than the 10% conventional threshold, indicating that the chosen instruments are less likely to be correlated with the error term. Therefore, in all the following regression analyses, we only report the results generated by the FD-GMM.

Table 4.8: Financial health and investment-SDM relation (Hypothesis II)

	Liquidity ratio		Solvency		Z-score	
Dependent:	High	Low	High	Low	High	Low
$I_{i,t}/K_{i.t-1}$	(1)	(2)	(3)	(4)	(5)	(6)
$Q_{i,t-1}$	0.016**	0.033***	0.020*	0.026***	0.016**	0.046***
	(0.007)	(0.011)	(0.010)	(0.009)	(0.007)	(0.013)
$CF_{i,t}/K_{i,t-1}$	0.067***	0.144***	0.201***	0.113***	0.131***	0.094***
	(0.009)	(0.041)	(0.077)	(0.021)	(0.021)	(0.025)
$Leverage_{i,t-1}$	-0.523***	-0.864***	-0.751***	-1.015***	-0.804***	-0.849***
	(0.148)	(0.187)	(0.233)	(0.231)	(0.206)	(0.217)
$SDM_{i,t-1}$	**-0.093**	**-0.529****	**-0.271****	**-0.646****	**-0.383****	**-0.594****
	(0.078)	(0.099)	(0.097)	(0.161)	(0.129)	(0.119)
Z-statistics	3.455***		1.997**		1.198	
AR(2) test (p-value)	0.765	0.971	0.263	0.804	0.597	0.726
Hansen test (p-value)	0.034**	0.157	0.315	0.359	0.216	0.202
Firms	832	689	686	696	824	678
Observations	6738	7223	6070	6522	6504	7196

First-differenced GMM estimators are reported. Equation (4.1) is first-differenced and all independent variables are lagged twice and more as instruments. Standard errors are reported in brackets. P-values of AR(2) test and Hansen test are reported. *, ** and *** denote statistical significance at 10%, 5% and 1% conventional levels, respectively. In columns (1) and (2), a firm is classified into 'High' group, if it has at least 60% observations that present values of liquidity ratio larger than the sample median value of this variable. A firm is classified into 'Low' group, if it has no more than 40% observations that present values of liquidity ratio smaller than the sample median value of this variable. Similarly, in columns (3), (4), (5) and (6), we classify firms by referring to their values of solvency and Z-score respectively. Z-statistic is calculated to identify the statistical significance of the difference in two coefficients on SDM between High and Low groups. For example, using solvency category results, Z-statistic = (-0.271+0.646)/sqrt(0.097^2+0.161^2) = 1.997, which produces a P-value equal to 0.046. Definitions of all variables are available in Appendix C.

4.7.2 'Good' and 'bad' states

To test **Hypothesis II**, we estimate equation (4.1) by using the data of firms in the group with good or bad financial health. The results are reported in Table 4.8. Obviously, the absolute value of coefficient on SDM for the firms in 'Low' financial health group is much larger than the absolute value of coefficient on SDM for the firms in 'High' financial health group. Such a tendency is quite consistent across all three measurements of firms'

financial conditions. Referring to the results in columns (3) and (4) as example, for an average firm with lower (higher) solvency, a 10% increase in SDM will lead to a reduction in investment by 0.047 (0.019). In the bottom of Table 4.8, we also calculate the z-statistics for checking the significance of difference between two coefficients on SDM across 'High' and 'Low' groups (Paternoster et al., 1995). The corresponding null hypothesis, that the difference between two coefficients is insignificantly different from zero, can be rejected at 1%, 5% and 12% significant levels for liquidity, solvency and Z-score specifications, respectively. These results strongly support our **Hypothesis II** that the firms with worse financial conditions tend to face higher rollover risks and hence are less likely to take positive growth opportunities given shorter debt maturity.

Table 4.9: Financial crisis effect (Hypothesis II)

	Full sample		Listed before 2008
Dependent:	Before 2009	After 2008	After 2008
$I_{i,t}/K_{i.t-1}$	(1)	(2)	(3)
$Q_{i,t-1}$	0.036***	0.007	0.032***
	(0.009)	(0.006)	(0.008)
$CF_{i,t}/K_{i,t-1}$	0.122***	0.141***	0.058***
	(0.028)	(0.012)	(0.019)
$Leverage_{i,t-1}$	-1.097***	-0.901***	-0.337*
	(0.285)	(0.182)	(0.174)
$SDM_{i,t-1}$	**-0.814****	**-0.224****	**-0.263****
	(0.166)	(0.104)	(0.085)
Z-statistics	3.006***		2.951***
AR(2) test (p-value)	0.773	0.637	0.899
Hansen test (p-value)	0.478	0.183	0.871
Firms	1105	1595	1196
Observations	6735	9697	8115

First-differenced GMM estimators are reported. Equation (4.1) is first-differenced and all independent variables are lagged twice and more as instruments. Standard errors are reported in brackets. P-values of AR(2) test and Hansen test are reported. *, ** and *** denote statistical significance at 10%, 5% and 1% conventional levels, respectively. Z-statistic is calculated to identify the statistical significance of the difference in two coefficients on SDM between High and Low groups. In columns (1) and (2), 2009 year is used as threshold to classify observations. The main reason is that the 4 trillion fiscal stimulus plans was firstly implemented in 2009. In column (3), we eliminate all firms that were listed before year 2008, thereby considering the entry effect. Definitions of all variables are available in Appendix C.

Table 4.9 contains the estimation results covering the potential effects of 2009 credit expansion on the relation between investment and SDM. In columns (1) and (2), we can see that the absolute value of the coefficient on SDM is equal to 0.814 before the year 2009 and it becomes much smaller in the period thereafter, i.e. 0.224. According to the Z-statistic, the difference between these two coefficients is highly statistically significant.

More specifically, a 10% increase in SDM leads to a reduction in investment by 0.063 (0.015) before 2009 (after 2008). To eliminate the entry effects, we repeat the analysis in column (2) by using the data of the firms listed before 2008. Comparing the results between columns (1) and (3), we can still conclude that the negative impact from SDM on capital expenditures becomes much weaker in the period after 2008, even after controlling the entry effects. These results are consistent with our predication that the rollover risk is reduced after 2008 financial crisis due to large fiscal stimulus in the Chinese economy.

Table 4.10: State ownership

Dependent: $I_{i,t}/K_{i.t-1}$	State (1)	Non-State (2)
$Q_{i,t-1}$	0.030***	0.016*
	(0.008)	(0.008)
$CF_{i,t}/K_{i,t-1}$	0.179***	0.137***
	(0.021)	(0.016)
$Leverage_{i,t-1}$	-0.374**	-0.791***
	(0.174)	(0.168)
$SDM_{i,t-1}$	**-0.150****	**-0.440****
	(0.084)	(0.107)
Z-statistics	2.129**	
Year dummies	Yes	Yes
AR(2) test (p-value)	0.652	0.330
Hansen test (p-value)	0.125	0.189
Firms	779	742
Observations	7704	4741

First-differenced GMM estimators are reported. Equation (4.1) is first-differenced and all independent variables are lagged twice and more as instruments. Standard errors are reported in brackets. In columns (1) and (2), we define a firm's ownership type by using the nature of its ultimate controller. If a firm's ultimate controller is state, then it is classified as 'State' group. If a firm's ultimate controller is non-state investor, then it is classified as 'non-State' group. P-values of AR(2) test and Hansen test are reported. Z-statistic is calculated to identify the statistical significance of the difference in two coefficients on SDM between State and non-State groups. *, ** and *** denote statistical significance at 10%, 5% and 1% conventional levels, respectively.

4.7.3 Ownership structures

Table 4.10 reports the results of ownership effects on the relation between investment and short debt maturity. The coefficient on SDM is -0.15 for SOEs and -0.44 for non-SOEs. The difference between these two coefficients is statistically significant. Specifically, for non-SOEs, a 10% increase in average value of SDM will lead to a reduction in fixed investment by 0.03. For SOEs, a 10% increase in average value of SDM will lead to a reduction in fixed investment by 0.01. These regression results are opposite to the previous

results provided by our univariate tests in section 6.3 of this chapter. After controlling the investment opportunities as well as the potential endogenous issue, we find that non-SOEs tend to suffer more from the rollover risks brought by short debt maturity than do SOEs.

Another interesting question is whether or not SOEs were indeed able to receive more subsidizing from banks than non-SOEs during the credit expansion period. If the answer is yes, then the rollover risk may not be important for SOEs after the crisis. We simply repeat the analysis presented in Table 4.9 for SOEs and non-SOEs. The results are reported in Table 4.11. For both state and non- SOEs, the negative impact from SDM on investment has reduced by around 50% after the crisis. Nevertheless, the coefficients on both leverage and SDM terms in column (2) become statistically insignificant for SOEs. Therefore, our results may indirectly support the finding in Huang et al. (2016) that SOEs are more favoured by the stimulus plan.

Table 4.11: State ownership and financial crisis

	State		Non-state	
Dependent: $I_{i,t}/K_{i.t-1}$	Before crisis (1)	After crisis (2)	Before crisis (3)	After crisis (4)
$Q_{i,t-1}$	0.028*	0.031***	0.039*	0.006
	(0.016)	(0.009)	(0.021)	(0.009)
$CF_{i,t}/K_{i,t-1}$	0.169***	0.188***	0.130***	0.144***
	(0.029)	(0.032)	(0.025)	(0.021)
$Leverage_{i,t-1}$	-0.791**	-0.221	-1.056***	-0.840***
	(0.384)	(0.225)	(0.344)	(0.205)
$SDM_{i,t-1}$	**-0.328***	**-0.155**	**-0.614****	**-0.329*****
	(0.191)	(0.112)	(0.272)	(0.120)
Z-statistics	0.782		0.957	
Year dummies	Yes	Yes	Yes	Yes
AR(2) test (p-value)	0.828	0.390	0.860	0.618
Hansen test (p-value)	0.268	0.612	0.647	0.148
Firms	606	689	275	688
Observations	3053	4651	1191	3550

First-differenced GMM estimators are reported. Equation (4.1) is first-differenced and all independent variables are lagged twice and more as instruments. Standard errors are reported in brackets. P-values of AR(2) test and Hansen test are reported. *, ** and *** denote statistical significance at 10%, 5% and 1% conventional levels, respectively. Z-statistic is calculated to identify the statistical significance of the difference in two coefficients on SDM between different groups. Definitions of all other variables are available in Appendix C.

4.8 Robustness tests

4.8.1 Over-reliance on short-term debt

Short-term debt has cost advantage over, but incurs higher refinancing risk, than long-term debt. Theoretically, firms can choose a shorter but optimal maturity structure by balancing the interest benefits and the rollover costs of short-term debt (Jun and Jen, 2003). This indicates that the firms with excessive proportion of short-term debt in their debt structure tend to suffer more from refinancing pressure and hence have lower incentives to take positive growth opportunities. In other words, the negative coefficient on SDM in equation (4.1) presented in Table 4.7 may be driven by the group of firms with too much short-term debt. If this conjecture is correct, then we shall be able to conclude that over-reliance on short-term debt can damage investment incentives of firms.

We use two different methods to consider the possible situation mentioned above. First, we follow the conventional debt maturity literature to parameterize short debt maturity as a linear function of lagged growth opportunities, leverage, size, tangibility, profitability, asset maturity and year effects (Barclay and Smith, 1995). Then, we use the coefficients generated by fixed effects estimators to predict firms' next period target/ optimal short debt maturity. After that, we calculate the difference between the predicted value and the actual value of short debt maturity. If a firm-year observation presents at least 5% above (below) its optimal short debt maturity, then it is regarded as having excessive (insufficient) short-term debt. Lastly, we create two dummy variables: if an observation presents excessive state, then $OverSDM_{i,t-1}$ is equal to one, otherwise zero. Similarly, if an observation presents insufficient state, then $UnderSDM_{i,t-1}$ is equal to one, otherwise zero. The other method is that of directly classifying firm-year observations into the excessive or insufficient group according to the industry median value of short debt maturity. Either method has its own advantages and disadvantages. For example, our first strategy contains more comprehensive information which may determine managers' incentives to choose maturity structure while it may suffer from systematic measurement errors in the prediction. Although the second approach avoids the measurement problem, it relies on a strict assumption that industry median can be a good proxy for target short debt maturity for all different firms in the same industry. We replace the SDM term in equation (4.1) by $OverSDM_{i,t-1}$ and $UnderSDM_{i,t-1}$ and report the results in Table 4.12.

Table 4.12: Over-reliance on short-term debt

	Predicted SDM		Industry median SDM	
Dependent: $I_{i,t}/K_{i.t-1}$	Excess (1)	Deficiency (2)	Excess (3)	Deficiency (4)
$Q_{i,t-1}$	0.023***	0.021***	0.016***	0.017***
	(0.005)	(0.005)	(0.005)	(0.005)
$CF_{i,t}/K_{i,t-1}$	0.140***	0.140***	0.149***	0.148***
	(0.010)	(0.010)	(0.010)	(0.010)
$Leverage_{i,t-1}$	-0.229**	-0.183*	-0.994***	-0.759***
	(0.117)	(0.108)	(0.145)	(0.124)
$OverSDM_{i,t-1}$	**-0.107****		**-0.173****	
	(0.033)		(0.032)	
$UnderSDM_{i,t-1}$		**-0.028**		**-0.007**
		(0.033)		(0.030)
AR(2) test (p-value)	0.881	0.769	0.862	0.927
AR(3) test (p-value)	0.631	0.603	0.514	0.403
Hansen test (p-value)	0.210	0.171	0.198	0.254
Firms	1769	1769	1769	1769
Observations	14662	14662	16432	16432

First-differenced GMM estimators are reported. Equation (4.1) is first-differenced and all independent variables are lagged twice and more as instruments. SDM_{it-1} in equation (4.1) is replaced by $OverSDM_{it-1}$ and $UnderSDM_{it-1}$. Standard errors are reported in brackets. P-values of AR(2) test and Hansen test are reported. *, ** and *** denote statistical significance at 10%, 5% and 1% conventional levels, respectively. In columns (1) and (2), we parameterize short debt maturity as a linear function of lagged growth opportunities, leverage, size, tangibility, profitability, asset maturity and year effects. Then, we use the coefficients generated by fixed effects estimators to predict firms' next period target/optimal short debt maturity. After that, we calculate the difference between the predicted value and the actual value of short debt maturity. If a firm-year observation presents at least 5% above (below) its optimal short debt maturity, then it is regarded as having excessive (insufficient) short-term debt. Lastly, if an observation presents excessive state, then $OverSDM_{i,t-1}$ is equal to one, otherwise zero. Similarly, if an observation presents insufficient state, then $UnderSDM_{i,t-1}$ equals to one, otherwise zero. In column (3), $OverSDM_{i,t-1}$ is a dummy variable equal to one if an observation presents a short debt maturity value larger the industry median value of this variable, otherwise zero. In column (4), $UnderSDM_{i,t-1}$ is a dummy variable equal to one if an observation presents a short debt maturity value smaller than the industry median value of this variable, otherwise zero. Definitions of all variables are available in Appendix C.

In columns (1) and (3) of Table 4.8, we can clearly see that the coefficient on $OverSDM_{i,t-1}$ is negative and highly statistically significant, regardless of the proxy for optimal SDM. More specifically, having excessive short-term debt, a firm will on average invest around 38% less than its counterparts. In contrast, in columns (2) and (4), the coefficient on $UnderSDM_{i,t-1}$ is small in magnitude and statistically insignificant, indicating that the overhang effect of short debt maturity is trivial for the firms who maintain their short-term debt level below the optima. The possible explanation is that for the firms with insufficient usage of short-term debt, the costs of underinvestment due to rollover risk are much larger than the loss from giving up the interest benefits of short-term

debt. Overall, although short-term debt can provide low interest costs, over-reliance on it can result in higher rollover risk and hence dampen the growth of firms.

Table 4.13: Time variant financial health indicators

Dependent: $I_{i,t}/K_{i.t-1}$	(1)	(2)	(3)
$Q_{i,t-1}$	0.023***	0.022***	0.008
	(0.005)	(0.005)	(0.008)
$CF_{i,t}/K_{i,t-1}$	0.147***	0.146***	0.148***
	(0.009)	(0.010)	(0.010)
$Leverage_{i,t-1}$	0.164	-0.959***	-0.494**
	(0.209)	(0.165)	(0.198)
$SDM_{i,t-1}$	-0.559***	-0.348***	-0.331**
	(0.216)	(0.094)	(0.139)
$Liquidity_{i,t-1}$	-0.059		
	(0.105)		
$Liquidity_{i,t-1} * SDM_{i,t-1}$	**0.281****		
	(0.095)		
$Solvency_{i,t-1}$		-0.285***	
		(0.099)	
$Solvency_{i,t-1} * SDM_{i,t-1}$		**0.202***	
		(0.115)	
$Z-score_{i,t-1}$			-0.027
			(0.019)
$Z-score_{i,t-1} * SDM_{i,t-1}$			**0.046****
			(0.021)
AR(2) test (p-value)	0.981	0.835	0.960
Hansen test (p-value)	0.234	0.175	0.011**
Firms	1769	1769	1769
Observations	16432	16432	16432

First-differenced GMM estimators are reported. All equations are first-differenced and all independent variables in each equation are lagged twice and more as instruments. Standard errors are reported in brackets. P-values of AR(2) test and Hansen test are reported. *, ** and *** denote statistical significance at 10%, 5% and 1% conventional levels, respectively. Definitions of all variables are available in Appendix C.

4.8.2 Time variant states

Our **Hypothesis II** indicates that the firms with worse financial health are more likely to suffer from refinancing risk. In the major results presented in Table 4.6, firms are not allowed to change their financial status. This may not be a very reasonable assumption. Therefore, in the robustness tests, we add an interaction term between financial health measurements and SDM in equation (4.1) and we expect that the interactive coefficient is positive and statistically significant. The results are reported in Table 4.9. In all three different specifications, from column (1) to (3), the coefficient on the interactive term is

significantly positive. In detail, controlling the liquidity ratio, Z-score and solvency ability at their sample averages, the negative marginal impact of SDM on capital expenditures can be reduced by 75%, 38% and 14%, respectively. Although the results in magnitude are different from what have been obtained by our pervious sample separation tests, they are still qualitatively consistent with each other. Therefore, we should be able to conclude that our **Hypothesis II** is valid given either time-variant or time-invariant financial health measurements.

4.8.3 Alternative definitions to variables

There are several reasons for us to choose different measurements of leverage. Consistent with previous literature, leverage is firstly constructed by using financial debt in our main tests. Nevertheless, for Chinese listed firms, more than 15% firm-year observations present zero financial debt. It is of concern that eliminating those observations may generate a selection problem. Furthermore, on average, financial debt constitutes less than 50% of the total liabilities in the dataset, indicating that the non-interest paying liabilities can also be an important source for liquidity pressure. According to the argument in Ding et al. (2013), Chinese firms prefer to well manage their working capital, thereby eliminating the effects of negative cash flow shocks on investment. On the other hand, having too much liability may reflect the relatively low working capital management ability and hence impose larger negative impact on real activities, i.e. similar impact to the overhang outcomes generated by financial debt. Besides, it is reasonable for a firm to have zero financial debt but not common to have zero total liabilities. Therefore, we are able to keep more observations by replacing the financial debt with liabilities. Correspondingly, the short debt maturity is expressed as the ratio of current liabilities to total liabilities. The results are reported in column (1) of Table 4.14. The coefficient on SDM is again negative and highly statistically significant, indicating that our major conclusion is still valid.

In addition, the discretionary investment may be in maintenance of plant and equipment. It may be in advertising or other marketing expenses, or in expenditures on raw materials, labour, research and development, etc. (Myers, 1977). If we view growth opportunities as call options, then debt overhang can prevent firms from exercising some of these options. Obviously, it is too narrow for us to limit those growth opportunities within the range of fixed capital expansion. Therefore, we follow Chen et al. (2011) and use cash payments for

fixed assets, intangible assets, and other long-term assets from the cash flow statement minus cash receipts from selling these assets to measure a firm's total investment. The results are reported in column (2) of Table 4.14. The coefficient on SDM is still significantly negative. A 10% increase in SDM will lead to reduction in total investment by 0.006 which is around 8.9% of the sample average value of total investment. Although the absolute value of the coefficient here is much smaller than what has been observed in Table 4.5, its economic impact on total investment is still important.

Table 4.14: Alternative definitions to variables

Dependent: $I_{i,t}/K_{i.t-1}$	Total Liabilities (1)	Total invests (2)	Growth (3)	Dummies (4)
$Q_{i,t-1}$	0.006 (0.004)	0.006*** (0.001)		0.025*** (0.005)
$Sales\ growth_{i,t-1}$			0.029** (0.012)	
$CF_{i,t}/K_{i,t-1}$	0.119*** (0.007)	0.207*** (0.015)	0.143*** (0.010)	0.145*** (0.010)
$Leverage_{i,t-1}$	-1.377*** (0.151)	-0.211*** (0.033)	-0.727*** (0.167)	-0.706*** (0.173)
$SDM_{i,t-1}$	**-0.879**** (0.172)	**-0.088**** (0.023)	**-0.370**** (0.096)	**-0.408**** (0.090)
Industry-Year dummies				Yes
AR(2) test (p-value)	0.411		0.644	0.444
AR(4) test (p-value)		0.416		
Hansen test (p-value)	0.237	0.092	0.158	0.131
Firms	2121	1690	1769	1769
Observations	19382	14395	16432	16432

First-differenced GMM estimators are reported. Equation (4.1) is first-differenced and all independent variables are lagged twice and more as instruments. Standard errors are reported in brackets. P-values of AR(2) test and Hansen test are reported. *, ** and *** denote statistical significance at 10%, 5% and 1% conventional levels, respectively. In column (1), $Leverage_{i,t-1}$ is defined as total liabilities divided by total assets; $SDM_{i,t-1}$ is defined as current liabilities divided by total liabilities. In column (2), the dependent variable is defined as cash payments for fixed assets, intangible assets, and other long-term assets from the cash flow statement minus cash receipts from selling these assets to measure a firm's total investment divided by last period total assets. In column (3), $Sales\ growth_{i,t-1}$ is defined as change of logarithm of real sales. In column (4), there are 44 different industries according to the SIC (2012) from CSRC. Definitions of all other variables are available in Appendix C.

Lastly, one of most challenging jobs in estimating the investment equation is the measurement of investment opportunities. In our case, we use average q to replace unobserved marginal q. However, such a proxy is widely recognized as an insufficient option (Cooper and Ejarque, 2003). If there is systematic measurement error in average q, then the lagged values of average q cannot be used as instruments (Ecrickson and Whited, 2000). Even worse, such measurement error may also correlate with financial factors and

results in unreliable interpretation for the corresponding coefficients in investment equation. To bypass this potential problem, we use sales growth to control for investment opportunities (Guariglia, 2008). Additionally, we also attempt to use the interaction of industry dummies and year dummies to capture the investment opportunities that can be anticipated (Brown et al., 2009). The results are reported in columns (3) and (4) of Table 4.14. Compared with the coefficient on SDM in column (3) of Table 4.7, no large difference is found in any specification here. Therefore, our major conclusion should not be significantly affected by the problem of measurement to investment opportunities.

4.8.4 Industry effects

The industry effect is largely controlled as fixed effect in our main analyses and it is eliminated mechanically by first-differencing equation (4.1). Intuitively, the real economic decisions of the firms in more external finance dependent industries should be more sensitive to the variations of financial factors. In our case, the negative impact of rollover risk caused by short-term debt should be more significant in those industries with high external finance dependent characteristic. We follow Rajan and Zingales (1998) to identify whether or not an industry is financially dependent. First, for each firm-year observation, the amount of external finance required is calculated as: total capital expenditure minus cash flow from operations plus decreases in inventories and plus decreases in receivable plus increases in payables. For each industry, we use the sum of this number over the sample period and then we divide it by the sum of lagged total capital expenditure. If an industry has this ratio larger (smaller) than the median value of this ratio over all industries, then this industry is classified as a high (low) external finance dependence industry. After that, we estimate equation (4.1) by using the data of firms in both external finance high-dependent and low-dependent industries. The results are reported in Table 4.15. Clearly, the financial dependent industries present a SDM coefficient with higher absolute value than the financial less dependent industries. The difference between two coefficients is again statistically significant. These results confirm the idea that rollover risk is more detrimental to the firms that heavily rely on external funds.

Table 4.15: Industry effects

Dependent: $I_{i,t}/K_{i.t-1}$	Low External Dependent (1)	High External Dependent (2)
$Q_{i,t-1}$	0.024***	0.026***
	(0.009)	(0.009)
$CF_{i,t}/K_{i,t-1}$	0.101**	0.044**
	(0.043)	(0.021)
$Leverage_{i,t-1}$	-0.833***	-1.579***
	(0.212)	(0.275)
$SDM_{i,t-1}$	**-0.430****	**-0.889****
	(0.122)	(0.164)
Z-statistics	2.244**	
Year dummies	Yes	Yes
AR(2) test (p-value)	0.628	0.948
Hansen test (p-value)	0.351	0.316
Firms	774	995
Observations	7243	9189

First-differenced GMM estimators are reported. Equation (4.1) is first-differenced and all independent variables are lagged twice and more as instruments. Standard errors are reported in brackets. P-values of AR(2) test and Hansen test are reported. *, ** and *** denote statistical significance at 10%, 5% and 1% conventional levels, respectively. For each firm-year observation, the amount of external finance required is calculated as: total capital expenditure minus cash flow from operations plus decreases in inventories and decreases in receivable and increases in payables. For each industry, we use the sum of this number over sample period and then we divide it by sum of lagged total capital expenditure. In columns (1) and (2), if an industry has this ratio larger (smaller) than the median value of this ratio over all industries, then this industry is classified as high (low) external finance dependence industry. Z-statistic is calculated to identify the statistical significance of the difference in two coefficients on SDM between two different groups. Definitions of all other variables are available in Appendix C.

4.9 Conclusion

In this chapter, using the CLFs dataset over 1998 – 2016, we have tested the casual relation from short debt maturity to firm's fixed capital expenditure. The short debt maturity is defined as the ratio of short-term debt to total debt. After controlling the level of leverage, we obtain a significant negative coefficient on short debt maturity in the investment regression model, indicating that rollover risk plays an important role in determining firm's investment decision. The implication of our results on the relation between debt maturity and investment is opposite to that of previous literature in this area. For example, both Aivazian et al (2005b) and Dang (2011) have presented a negative coefficient on long-term debt maturity defined as the ratio of long-term debt to total debt, i.e. a positive coefficient on short debt maturity, in the investment regressions. This is consistent with the argument in Myers (1977) that firms holding risky debt with longer

maturity are more likely to have lower investment incentives since their shareholders are unwilling to transfer returns from projects to debtholders. In other words, firms can reduce underinvestment issues by using more short-term debt. Nevertheless, such a working mechanism of debt maturity policy may only be valid in economies with very mature capital markets in which firms largely rely on long-term debt financing.

In most emerging economies, such as that of China, the high degree of asymmetric information plus a bank dominating financial system can easily result in high risk premium of the debt contract with longer maturity. Therefore, short-term debt may provide cost advantage over long-term debt for the firms in the economies with immature capital markets. However, the current flexibility of short-term debt is accompanied by high potential rollover risks which can substantially limit a firm's future borrowing. Given the prevalence of heavy reliance on short-term debt financing, it is reasonable for us to conjecture that firms in China with shorter debt maturity may act more conservatively in capturing growth opportunities due to either unaffordable costs of further borrowing or high existent rollover/ repayment pressure.

The model proposed by Diamond and He (2014) provides a good theoretical justification of our empirical results. They show that short-term debt can impose larger overhang costs when firm's assets-in-place deteriorates since short-term debtholders share less risk with firms at bad times. Our results demonstrate that the negative impact of shorter debt maturity on investment is significantly stronger in the firms with worse financial conditions, i.e. lower liquidity/ solvency/ Z-score. The explanation is that the rollover risks faced by these firms are much higher. Additionally, following several recent studies on the 2008 financial crisis effects on the relation between finance and investment, we have also tested our hypothesis separately by using the sample of data before and after the crisis. In contrast with the credit-supply contraction story relayed by western literature, we take advantage of China's 4 trillion fiscal stimulus plan implemented in 2009 and 2010 and study firms' behaviours during a credit boom period. The results show that shorter debt maturity imposes less negative impact on investment expenditures after 2008 and this is likely to have been caused by the usage of more long-term bank loans after the crisis.

The policy implications of our research are obvious. Chinese governments should keep deepening the reforms of financial markets and provide local non-financial firms with more alternatives for long-term debt financing. Nevertheless, this does not necessarily

mean that more fiscal stimulus packages, such as the 4 trillion one after 2008, should be utilized. Although such a policy-driven credit boom can increase firms' access to more long-term credits and temporally reduce the overall refinancing risks in the economy, it may put long-term growth in danger when a large amount of credit is allocated to inefficient sectors, e.g. SOEs and over-capacity industries, that may be unable to repay those debts at the future maturity date. To avoid this unwanted outcome, for example, it is probably wiser for governments to ameliorate institutional efficiency and to allow financial contracts to be executed more smoothly. This may reduce the costs of long-term financing fundamentally.

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Appendix C

$I_{i,t}/K_{i.t-1} = (K_{i,t} - K_{i.t-1} + depreciation_{i,t})/K_{i.t-1}$; $K_{i.t-1}$ is tangible assets

$Q_{i,t}$ Market to book ratio

$CF_{i,t}/K_{i,t-1}$ Earnings before interests, tax, depreciation divided by lagged tangible asset

$Leverage_{i,t}$ (Short-term debt + Long-term debt) / total assets

$SDM_{i,t-1}$ Short-term debt / (Short-term debt + Long-term debt)

Liquidity ratio = Current assets / Current liabilities

Solvency ratio = Net operating cash flow / (Short-term debt + Long-term debt)

Z-score = 1.2*working capital/total assets + 1.4*retained earnings/total assets + 3.3*earnings before interest and taxes/total assets + 0.6*Market value of equity/total liabilities + 1.0*sales/total assets

Size is the logrithem of total assets

Tangibility = fixed assets/total assets

Profitability = earnings before interest and tax/total assets

Asset maturity = Fixed assets/depreciation

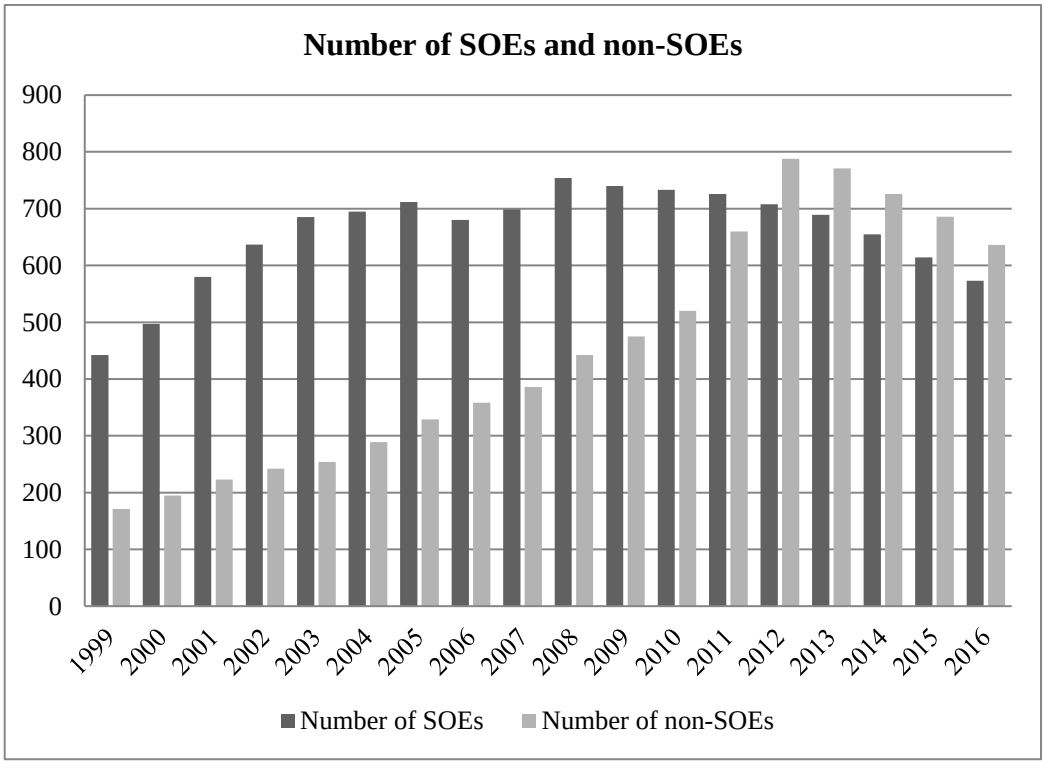

Figure C.4

Equation group (C.2):

$$\Delta Cash\ Balance_{t,j} = \alpha_1 + \beta_{11} * Net\ working\ capital\ invest_{t,j} + \beta_{21} * Net\ Fixed\ assets\ invest_{t,j} + \beta_{31} * Income\ available\ to\ shareholders_{t,j} + \beta_{41} * Dividends_{t,j} + \gamma_1 * controls_{t,j} + \varepsilon_{t,j1}$$

$$Short\ term\ Debt\ issue_{t,j} = \alpha_2 + \beta_{12} * Net\ working\ capital\ invest_{t,j} + \beta_{22} * Net\ Fixed\ assets\ invest_{t,j} + \beta_{32} * Income\ available\ to\ shareholders_{t,j} + \beta_{42} * Dividends_{t,j} + \gamma_2 * controls_{t,j} + \varepsilon_{t,j2}$$

$$Long\ term\ Debt\ issue_{t,j} = \alpha_3 + \beta_{13} * Net\ working\ capital\ invest_{t,j} + \beta_{23} * Net\ Fixed\ assets\ invest_{t,j} + \beta_{33} * Income\ available\ to\ shareholders_{t,j} + \beta_{43} * Dividends_{t,j} + \gamma_3 * controls_{t,j} + \varepsilon_{t,j3}$$

$$Equity\ issue_{t,j} = \alpha_4 + \beta_{14} * Net\ working\ capital\ invest_{t,j} + \beta_{24} * Net\ Fixed\ assets\ invest_{t,j} + \beta_{34} * Income\ available\ to\ shareholders_{t,j} + \beta_{44} * Dividends_{t,j} + \gamma_4 * controls_{t,j} + \varepsilon_{t,j4}$$

Ignoring the constant, the first four terms in each equation are the specific requirements for finance. The $controls_{t,j}$ terms include other determinants of financing choices. These five equations are estimated simultaneously (Seemly Unrelated regression, SUR) with the following coefficients constraints:

$$\begin{gathered} -\alpha_1 + \alpha_2 + \alpha_3 + \alpha_4 - \alpha_5 = 0 \\ -\beta_{11} + \beta_{12} + \beta_{13} + \beta_{14} - \beta_{15} = 1 \\ -\beta_{21} + \beta_{22} + \beta_{23} + \beta_{24} - \beta_{25} = 1 \\ -\beta_{31} + \beta_{32} + \beta_{33} + \beta_{34} - \beta_{35} = -1 \\ -\beta_{41} + \beta_{42} + \beta_{43} + \beta_{44} - \beta_{45} = 1 \\ -\gamma_1 + \gamma_2 + \gamma_3 + \gamma_4 - \gamma_5 = 0. \end{gathered}$$

The intuition is simple: each dollar use of finance should be fully accommodated by the combined changes in the four different sources of finance.

Table C.16: How do Chinese listed firms finance their investments? (Restricted coefficients)

	Dependent variables			
	Change in Cash Holdings (1)	Short-term Debt issues (2)	Long-term Debt Issues (3)	Equity Issues (4)
Intercept	-0.169***	-0.001	-0.071***	-0.096***
	(0.011)	(0.010)	(0.008)	(0.009)
Investment in Net Working Assets	**-0.224****	**0.344****	**0.254****	**0.176****
	(0.008)	(0.007)	(0.006)	(0.006)
Investment in Net Fixed assets	**-0.159****	**0.420****	**0.285****	**0.134****
	(0.006)	(0.005)	(0.004)	(0.005)
Income Available to Common	0.416***	-0.291***	-0.174***	-0.119***
	(0.011)	(0.010)	(0.008)	(0.009)
Dividends	-0.896***	0.415***	-0.065**	-0.245***
	(0.037)	(0.33)	(0.028)	(0.029)
Natural Log of Assets	0.008***	0.001***	0.003***	0.004***
	(0.000)	(0.000)	(0.000)	(0.000)
Market-to-Book Assets	0.004***	-0.003***	-0.000	0.007***
	(0.000)	(0.000)	(0.000)	(0.000)
Earnings-to-Assets	0.049***	-0.045***	0.048***	0.046***
	(0.007)	(0.007)	(0.006)	(0.006)
Leverage	-0.169***	-0.069***	0.001	0.059***
	(0.011)	(0.004)	(0.003)	(0.003)
Diff: [STD]fix - [LTD]fix		0.135***		
Diff: [STD]fix - [EQ]fix				0.286***
Diff: [STD]WK - [LTD]WK		0.090***		
Diff: [STD]WK - [EQ]WK				0.168***

Seemingly unrelated regression results are presented in this table. Standard errors are reported in brackets. All 4 equations are estimated simultaneously with coefficient constraints conditions listed above this table. Change in Cash holdings = (The change from year t-1 to t of Cash and Short-term investments); Short-term debt issues = (The change from year t-1 to t of short-term debt); Long-term debt issues = (The change from year t-1 to t of long-term debt); Equity issue is calculated as the cash received from the issuance of stocks net of commission and other issuance fees; Investment in net working assets = The change from t −1 to t of [Current Assets − Cash and Short-term Investments] − [Current Liabilities − Debt in Current Liabilities]; Investment in Net Fixed Assets = The change from t−1 to t of Net Property, Plant and Equipment. Dividends = Cash Paid For Distribution Of Dividends Or Profits Or Cash Paid For Interest Expenses. At the bottom of this table, we present the difference in the coefficients on investment in working capital and fixed capital between short-term debt and long-term debt equations; short-term and equity issue equations. *, ** and *** denote statistical significance at 10%, 5% and 1% conventional levels, respectively.

Table C.17: Financial condition between SOEs and non-SOEs

	SOEs	non-SOEs	Difference	P-value
Liquidity	1.398	1.719	-0.321***	0.000
Solvency	0.264	0.235	0.029***	0.000
Z-score	3.437	4.502	-1.065***	0.000
Observations	8151	11819		

Table C.18: Industry distribution

	Full sample	State	Non-State
Agriculture	393	182	211
Mining	709	535	174
Manufacturing	12,162	6,880	5,282
Construction	586	352	234
Retailing	1,656	1,124	532
Transportation	905	798	107
Accommodation	102	67	35
Technology	654	263	391
Real Estate	1,600	895	705
Leasing	289	148	141
Scientific research	58	21	37
Public facility	261	180	81
Education	24	18	6
Health	26	9	17
Culture	217	143	74
Diversified	328	204	124

SIC 2012 version

Chapter 5
Conclusion

5.1 Summary of this Thesis

Using annual firm-level NBS data (unlisted, 1998-2007) and CSMAR data (listed, 1998-2010; 1998-2016), this thesis studies Chinese firms' fixed capital accumulation and their capital structure decisions. After introducing our motivation, the research questions and the major findings, Chapter 2 starts with the empirical analyses of the variations of the degree of financing constraints faced by firms across the provinces and regions with different levels of institutions and financial development. First, we follow Fazzari et al. (1988) and use investment cash flow sensitivity to measure the degree of firm-level financing constraints. Then, we use the province-level Marketization index generated by Fan et al. (2009) to measure the status of regional development in institutions and finance in China. Using POEs as example, our results show that the firms located in the provinces with higher institutional and financial development present lower investment cash flow sensitivity and hence are likely to be less financially constrained. Notably, we find that such reduction in financing constraint degree seems to be more significant among the POEs without political background. This implies that the market-oriented reforms in China may narrow the financing gap between the firms with and without government connection, in the domestic capital market.

In Chapter 3, we turn to Chinese listed firms' capital structure policy. If we believe that the firms with different ownership structures face different costs of external capital, then we should see that ownership structures are correlated with firms' capital structure related decisions in some ways. Relying on the implications from dynamic trade-off theory, we apply the one-step reduced partial adjustment model of leverage (Flannery and Rangan, 2006) and estimate the optimal leverage converging speeds of firms with different ownership types as well as different levels of ownership concentration. Our results show that SOEs present significantly lower adjustment speed than POEs. The argument is that the abnormally low costs of default plus low tax saving incentives result in low incentives for managers in SOEs to eliminate deviations from optimal leverage. Furthermore, we find that there is a positive relation between ownership concentration and leverage adjustment speed, especially for POEs. The possible interpretation is that in a capital market with weak internal and external corporate governance mechanisms, a firm with more complex ownership structure tends to face higher costs of external financing and hence larger costs of leverage adjustment (Lin et al., 2011). Differently from US firms with quite diffused

ownership structures, Chinese firms may use higher ownership concentration to reduce information and transaction costs in their financing activities.

In Chapter 4, we are back to investment behaviour and further consider the potential underinvestment issue caused by firms' heavy reliance on short-term debt financing. Specifically, short-term bank loan is the major debt financing resource for most non-financial Chinese firms since the costs of long-term financing are quite high in China's immature capital market. The average debt maturity of Chinese listed firms in our dataset is 0.28, which is 'abnormally' low compared with the 0.72 of US firms. This fact motivates us to explicitly explore the firm-level real economic outcome of such an 'extreme' debt maturity structure choice. In the investment regression model, we obtain a significant negative coefficient on the short debt maturity term measured as the ratio of short-term debt to total debt. This indicates that the Chinese firms with shorter debt maturity structure tend to invest less. The most possible explanation is that they face high rollover risks and act more conservatively in taking up positive growth opportunities. Our empirical analyses offer another important channel for understanding the interaction between firms' investment and external financing decisions.

Different from many countries in eastern Europe, China's initial reform efforts began as experimental changes aimed at improving performance rather than establishing a Western-style market system (Jefferson and Rawski, 1994). Therefore, it is not surprising that institutional change has been gradual and uneven, with many features of the pre-reform system surviving even today. Our findings suggest that market-oriented developments in the institutions and the financial system in China impose positive effects on the growth of private sector. Therefore, the Chinese government should deepen the decentralization and marketization of the economy. For example, the deposit rate liberalization would motivate the Chinese (state owned) banks to compete for more deposit at higher interest costs[92]. This should force those banks to increase their efficiency by increasing share of lending to POEs, which tend to make much better use of the funds than SOEs. Also, the government can further promote the creation of truly private banks. In 2013 and 2014, the State council together with the China Banking Regulatory Commission provided detailed guiding lines and regulation for establishing (private) banks. Besides, the public corporate bond market requires to be developed and is expected to offer local non-financial firms more

[92] In October 2015, The People's Bank of China allowed the deposit rate to be upward fluctuated more than 50% of the reference rate. In April 2018, it announced a draft to further increase the upper limit of deposit rate fluctuation.

alternatives for long-term debt financing. These institutional and financial arrangements should be able to improve POEs' access to debt credits and hence reduce the credit misallocation between state and non-state sectors in the Chinese economy.

5.2 Directions for Future Research

5.2.1 External debt financing and market-oriented reforms

In Chapter 2, we have only used investment cash flow sensitivity to indirectly measure the degree of financing constraints faced by firms. Is there any other more direct method? Strictly speaking, we should always add a word 'external' in front of the phrase 'financing constraint'. The intrinsic assumption behind the correlation between investment and cash flow is that external debt financing is (very) expensive for some firms regarded as financially constrained. Therefore, one most straightforward approach should be estimating a regression with debt related dependent variables. The independent variables should contain conventional determinants of firms' debt usage and the marketization index. The key hypothesis can be: the firms located in more developed regions use more debt financing. Nevertheless, there are still some problems about this approach. First, in the given NBS dataset, for unlisted firms, there is no clear information on financial debt usage. Although there is a total liability term, it is still too risky for us to equalize the non-interest generating liabilities and interest generating ones since we are more interested in whether or not developments can increase not only the supply of credit but also the access to external financial resources. Second, the financing constraint theory actually indicates that financially constrained firms cannot get enough financial resources to support the projects that should be otherwise taken on. To express such a concept, we can simply create an interactive term between investment opportunities and the marketization index in the debt regression model. If those developments can help firms to capture positive growth opportunities by borrowing more, then the corresponding coefficient should be positive. Unfortunately, for unlisted firms, measurements of investment opportunity can be a huge problem. Even worse, the potential endogenous issues in this framework can be too complex to handle. GMM estimators are probably not enough to solve these problems. Therefore, we recommend this general idea for future research.

5.2.2 State-contingency and Capital structure theories

Whether or not firms have optimal capital structures is a fundamental question in corporate finance study. Finding answers for this question necessitates exploring which one of the mainstream capital structure theories presents better explanatory power for firms' financing decisions. Over more than four decades debate, however, scholars still have not obtained agreement on the existence of such unobservable optimal ratios. Nevertheless, one thing can be settled. The applicability of any capital structure theory, including the trade-off theory, is state-contingent and is likely to differ from situation to situation. In other words, it might not be wise for future research to attempt to find or justify a general capital structure theory which can perfectly describe firms' financing decisions in all situations. Instead, scholars should figure out what sorts of firms in which situations are more likely to follow the guidance from which theory.

For example, the concentration of recent studies has turned to whether or not pursuing the optimal capital structure is a first-order issue in corporate financing decisions. The logic is simple. Firms can access external capital market if they have specific financial requirements, such as investment and growth opportunities. Meanwhile, if maintaining/ pursuing optimal capital structure is indeed very important, then the securities issuances of firms should also be motivated by the requirements of eliminating deviations from their optimal capital structures. If firms prefer to firstly satisfy their financial deficits and then adjust their capital structures later on, or do not proactively react to the corresponding changes in their capital structures, then maintaining the optimal capital structures is probably just a second-order issue or even unimportant. Using the US firms dataset, the published evidence of this new research topic suggests that firms' specific choices depend on the shocks in investment opportunities, past and current financial health as well as the accessibility of external capital market, i.e. the degree of financial constraints. Clearly, none of the existing capital structure theories has covered all these factors at the same time.

5.2.3 Employment, Productivity and Indebtedness level

There is no reason for us to limit the impact from capital structure related decisions on firms' capital expenditures only. As emphasized by Myers (1977), growth opportunities can be in advertising or other marketing expenses, or in expenditures on raw materials, labour, research and development. Several studies using the US firms dataset have done

research on the relation of financial decisions to employment decisions. For Chinese firms, however, no such studies have been available until now. The ongoing decentralization and marketization in the Chinese economy have resulted in rapid wage growth as well as in wider wage disparities between skill-intensive and labour-intensive industries (Yang and Chen, 2010). It should be interesting to know in which way a Chinese firm's financial decisions may be connected with its employment policy. Furthermore, although several studies have provided empirical analyses for the productivity and leverage relation, it seems that systematic theoretical justifications for the empirical results are still insufficient. Among the works on productivity of Chinese firms, there are one or two that present a positive relation between cash flow and productivity. Nevertheless, to the best of our knowledge, no systematic research on the relation between leverage and productivity has been conducted by using Chinese firm-level data. There are at least two reasons for us to propose this research topic. First, the relatively frequent and high strength fiscal and monetary stimulus over the past decade in China may have pushed the indebtedness level of the corporate sector over the sustainable boundary. Although these policies prevent a hard lending of Chinese economy temporarily, they may also result in some unwanted negative impact on long-run economic growth. Compared to decline in the space of capital accumulation, increase in employment wage and decrease in productivity may be of more vital concern for the economy. Having excessive debt may prevent firms from investing in high levels of human capital and in skilled employees which are essential for innovation and productivity increase.

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